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THE NATIONAL GEOGRAPHIC MAGAZINE

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CONTENTS

Reptiles of All Lands — RAYMOND L. DITMARS
With 32 Illustrations

The Indian Census of 1911 — JOHN J. BANNINGA
Illustrated

Boys' and Girls' Agricultural Clubs
Illustrated

A Woman's Climbs in the High Alps — DORA KEEN
With 28 Illustrations

Our Friends, the Bees — A. I. ROOT AND E. R. ROOT
With 21 Illustrations

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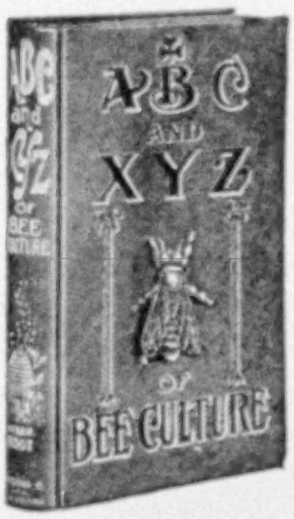

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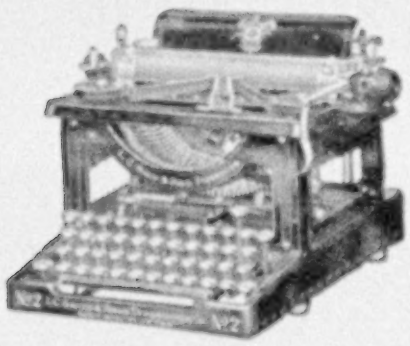

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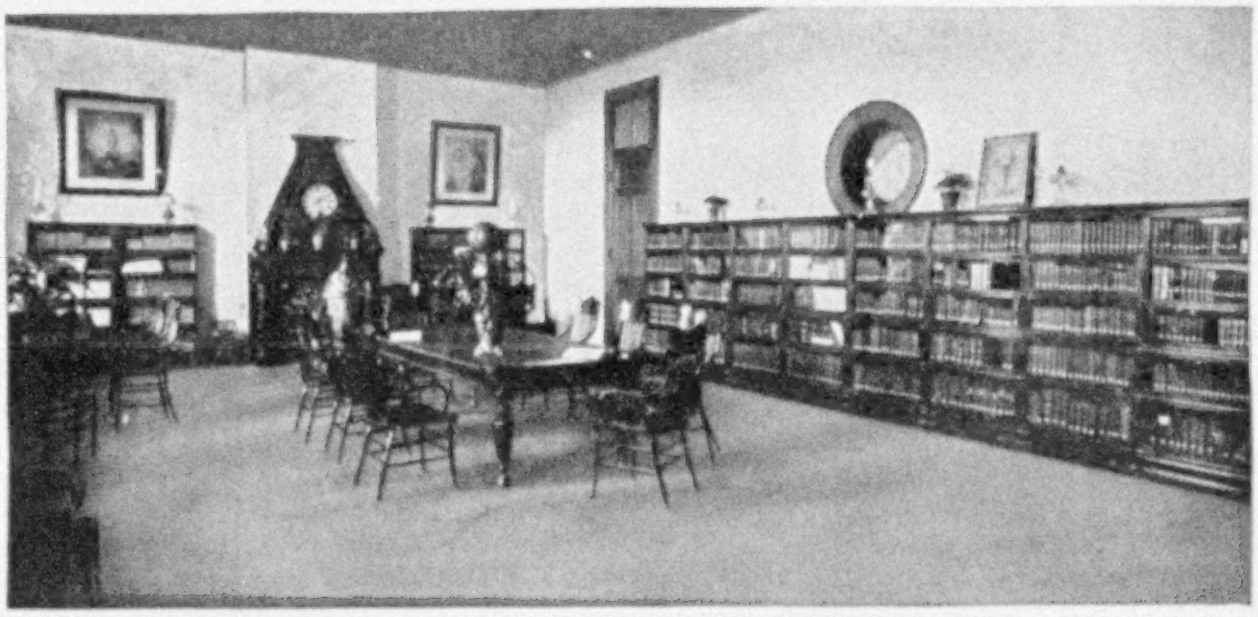

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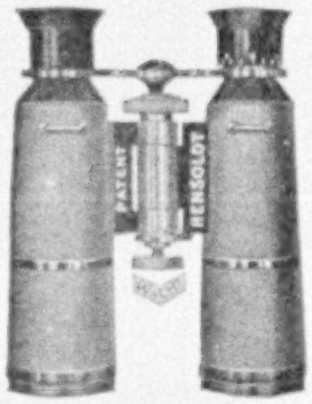

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VOL. XXII, No. 7 WASHINGTON JULY, 1911

THE NATIONAL GEOGRAPHIC MAGAZINE

REPTILES OF ALL LANDS

By Raymond L. Ditmars

Curator of Reptiles, N. Y. Zoölogical Park, and Author of "The Reptile Book," "Reptiles of the World," etc.

IN THE four orders of scaled and shielded forms that make up the class of reptiles, we have a vivid illustration of a rapidly degenerating race of creatures. The reptiles of former periods—of hundreds of thousands of years ago—were by far the most gigantic inhabitants of this globe.

In comparison with the ages of other groups of the earth's varied vertebrate life, the reptiles have passed through some abruptly terminated epochs. Paleontology teaches us that the age of gigantic reptiles came to a sudden close. Important climatic changes or disturbances were probably responsible for this, for warmth is one of the absolute necessities of a reptile's life. The earth is undoubtedly a far cooler sphere than during the age of the great reptiles.

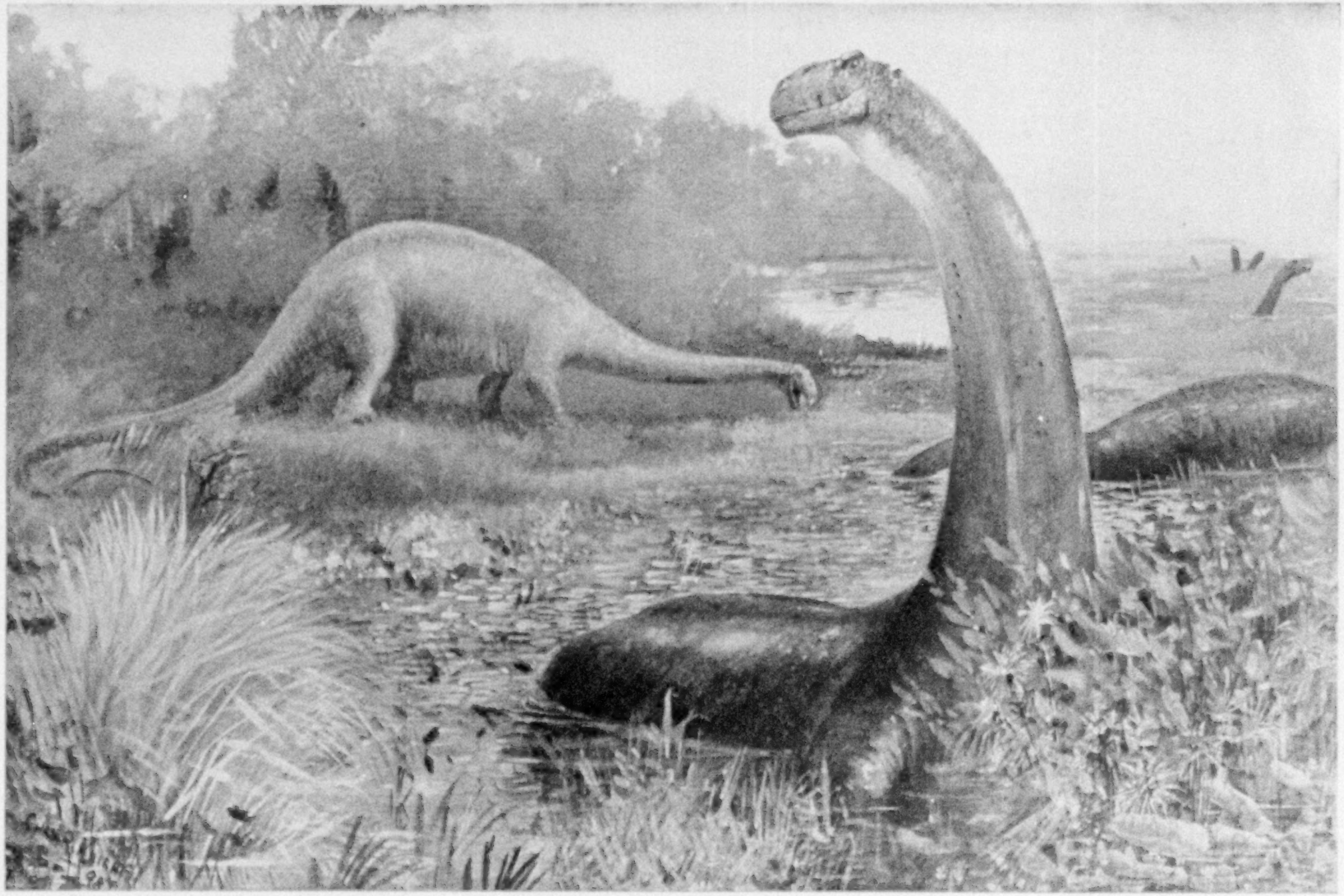
In consequence we find the legions of modern reptiles, the members greatly reduced in size, occurring compactly around the world within the equatorial parallels. As we look to the north or the south, away from the region of greatest heat, the number of species and the size of their representatives will be seen to rapidly decline. The reptiles of the temperate zones are of comparatively insignificant size and pass the cold season in an absolutely dormant and helpless condition.

While the trend of evolution has been to greatly reduce the size of the surviving reptiles, the variability and number of forms have as substantially increased. In the ages that are gone a bird's-eye view of the earth's surface would have revealed varied, monstrous forms lumbering here and there, reveling in an atmosphere reeking with humidity; some browsing in giraffe-like fashion among high branches, others churning through the sea in pursuit of their prey; even in the murky atmosphere itself cold-blooded creatures like gigantic bats flapped their way in pursuit of equally gigantic insects.

While but a very few examples of the modern reptiles anywhere approach the size of their rock-bound and now fossil ancestors, they occur to the number of over 4,000 species. It should have been explained that a fifth order of reptiles has its place in classification. It is made up of a single genus and species, the tuatera, a lizard-like creature of New Zealand. It is the oldest surviving type of reptile and apparently related to the long-extinct *Plesiosaurus*.

CROCODILES AND ALLIGATORS

Of direct, ancient lineage, the modern crocodiles and alligators furnish us with a hint of the gigantic forms of reptile life



BRONTOSAURUS

The Brontosaurs ranged from 40 to 60 feet long. Their thigh bones measured 5 to 6 feet in height, being the largest single bone known to us, while some of the vertebræ were 4½ feet high, exceeding in dimensions those of the whale. From F. A. Lucas, Director American Museum of Natural History, in "Animals of the Past." Courtesy of the American Museum of Natural History and Dr. Henry Fairfield Osborn.

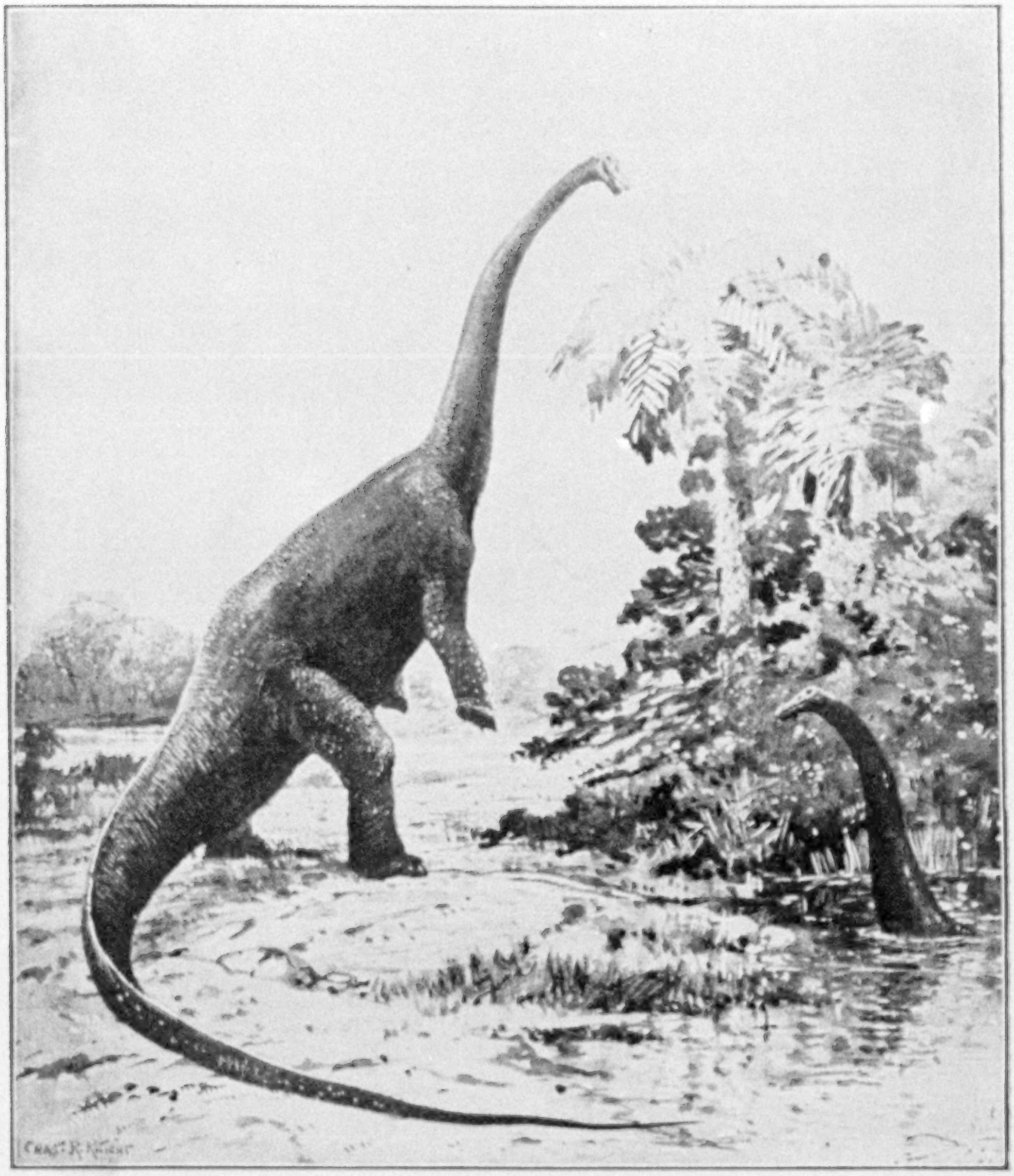
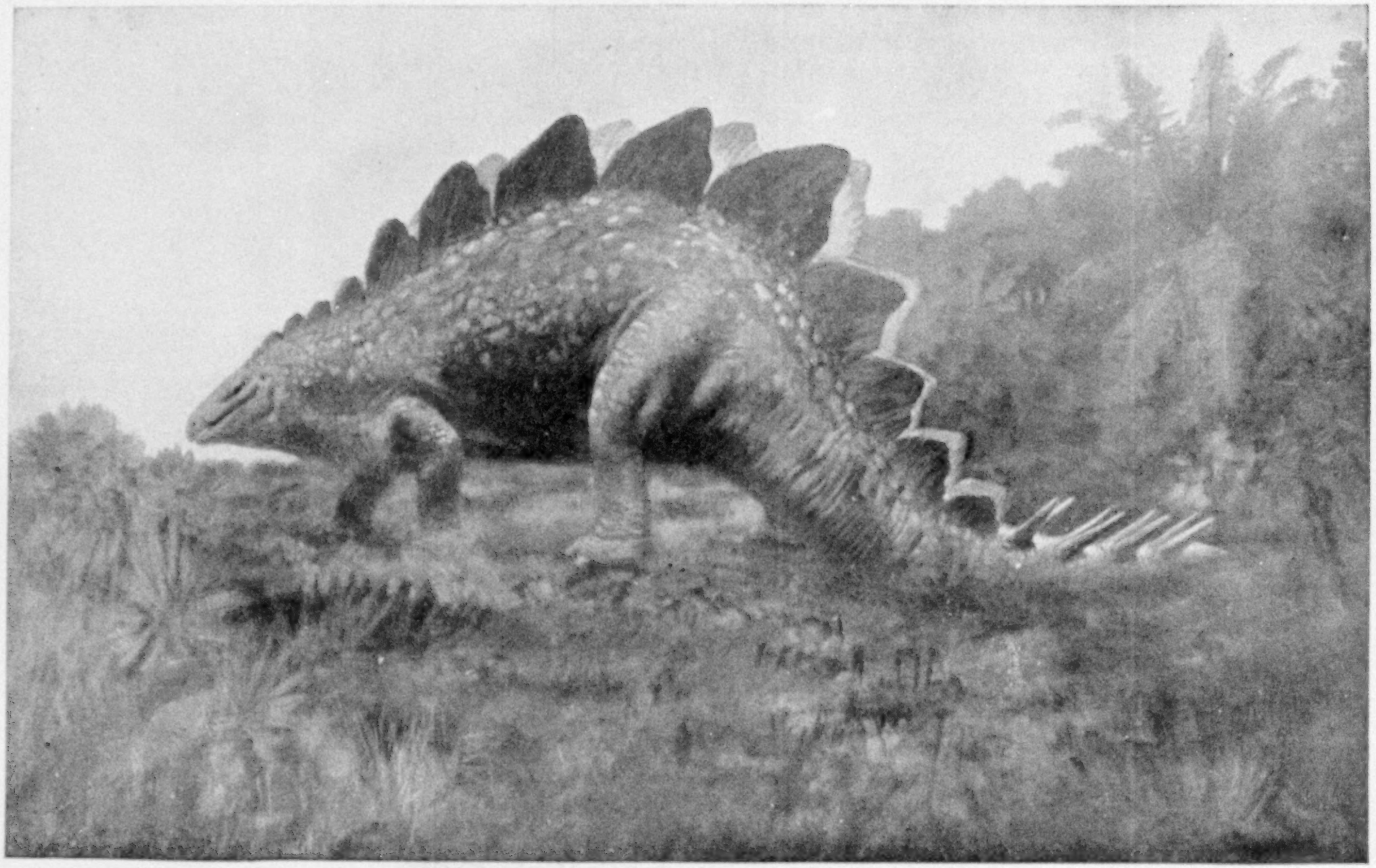


ILLUSTRATION OF THE DIPLODOCUS

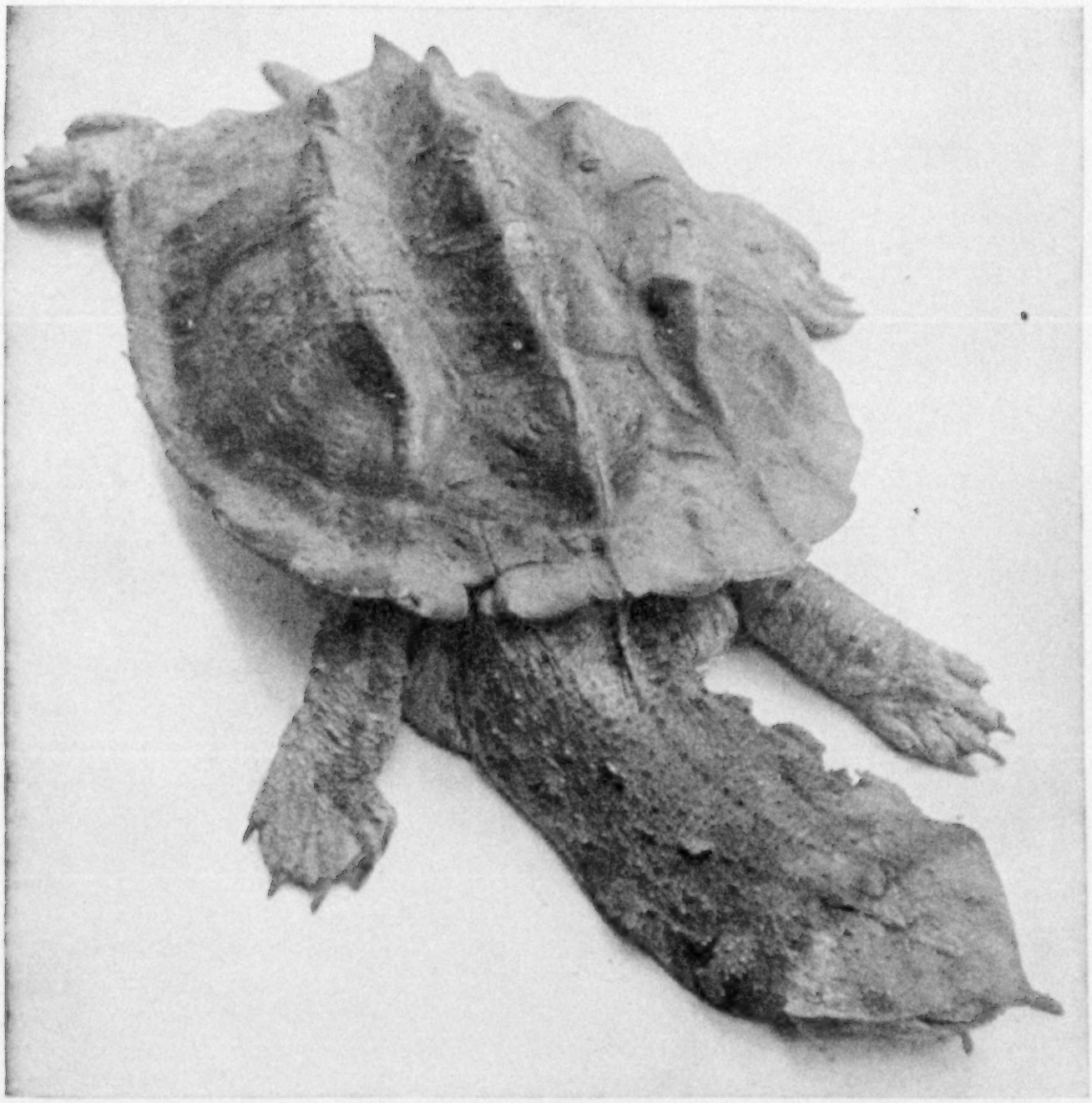
The head was so small and so poorly provided with teeth that it must have been quite a task or a long-continued pleasure, according to the state of its digestive apparatus, for the animal to have eaten its daily meal. It is pretty safe to say that the Diplodocus weighed 20 tons and would devour over 700 pounds of leaves or twigs or plants each day. One can readily see the advantage of the long neck in browsing off the vegetation on the bottom of shallow lakes while the animal was submerged, or in rearing the head aloft to scan the surrounding shores for the approach of an enemy; or, with the tail as a counterpoise, the entire body could be reared out of water and the head be raised some 30 feet in the air. From F. A. Lucas, Director American Museum of Natural History, in "Animals of the Past." Photo from the late Charles R. Knight.

once existing. Ages ago the crocodilians were generally distributed throughout the world; the zone of decadence is now marked by fossils in the temperate regions, giving way to the living representatives which have survived within the tropics. While a few species stray out of this area, their distribution fol-



STEGOSAURUS

The Stegosaurs, or Plated Lizards, were among the most singular of all known animals. They had diminutive heads, small fore legs, long tails armed on either side near the tip with two pairs of large spines, while from these spines to the neck ran series of large, but thin and sharp-edged plates, standing on edge, so that their backs looked like the bottom of a boat provided with a number of little centerboards. Photo from F. A. Lucas, Director American Museum of Natural History, and Charles R. Knight.



ONE OF NATURE'S NONDESCRIPTS: MATAMATA (*Chelys fimbriata*), GUIANAS

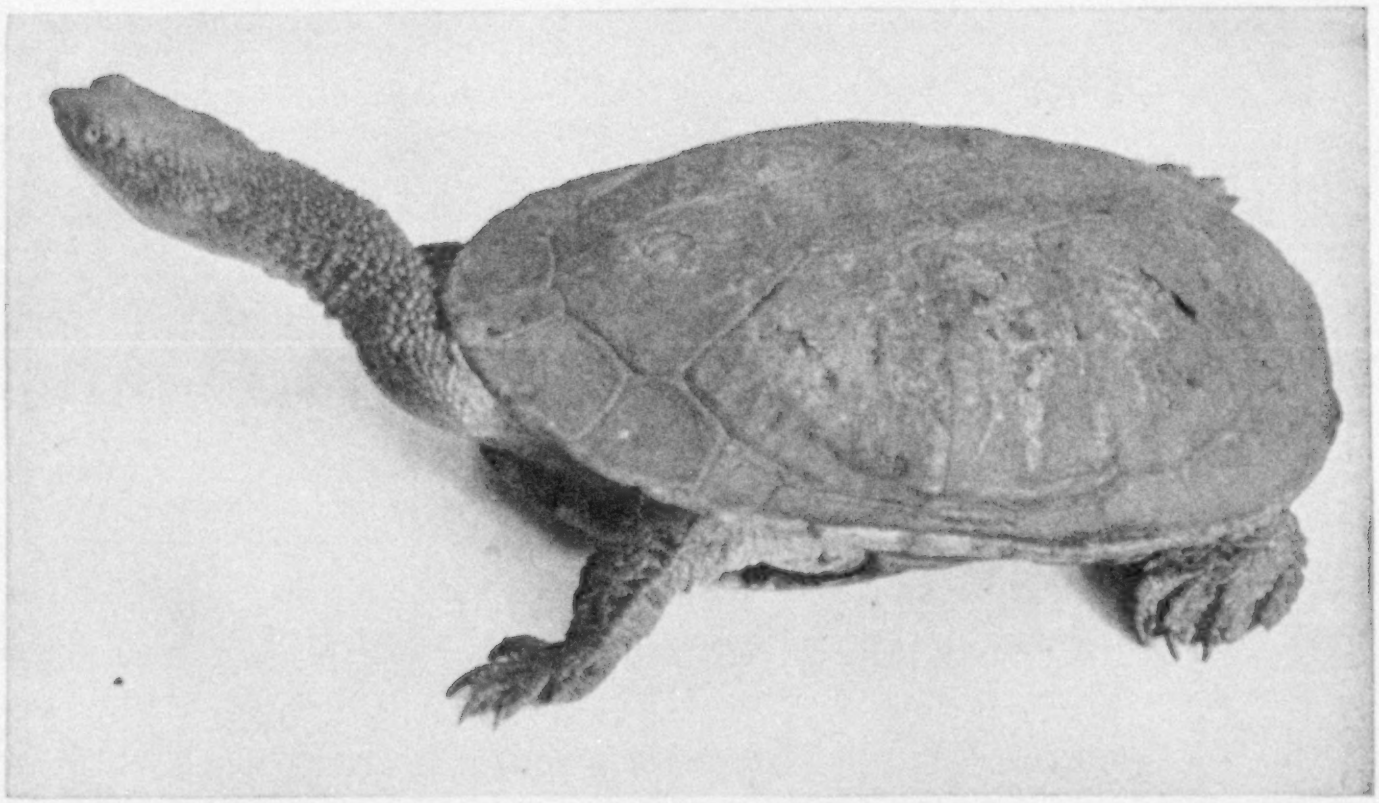
The flattened head terminates in a tubular appendage, the neck has a waving fringe, while the eyes are incongruously small. Its temper is in keeping with its looks (see page 608). Photo by Raymond L. Ditmars.

lows low coastal regions warmed by currents from the tropics.

The largest modern reptile occurs in India, along the Ganges and the Brahmaputra. This is the gavial, a remarkable reptile attaining a length of 30 feet. Despite its great size and bulk and its tooth-studded jaws, it is a timid animal, dashing into the silty, opaque water at the sight of man. Judging from the massive structure of a big specimen, one might be led to believe it would literally wallow for the water when frightened. It is quite nimble, however, and the ponderous creature actually runs for the sheltering current. The prey consists of fish.

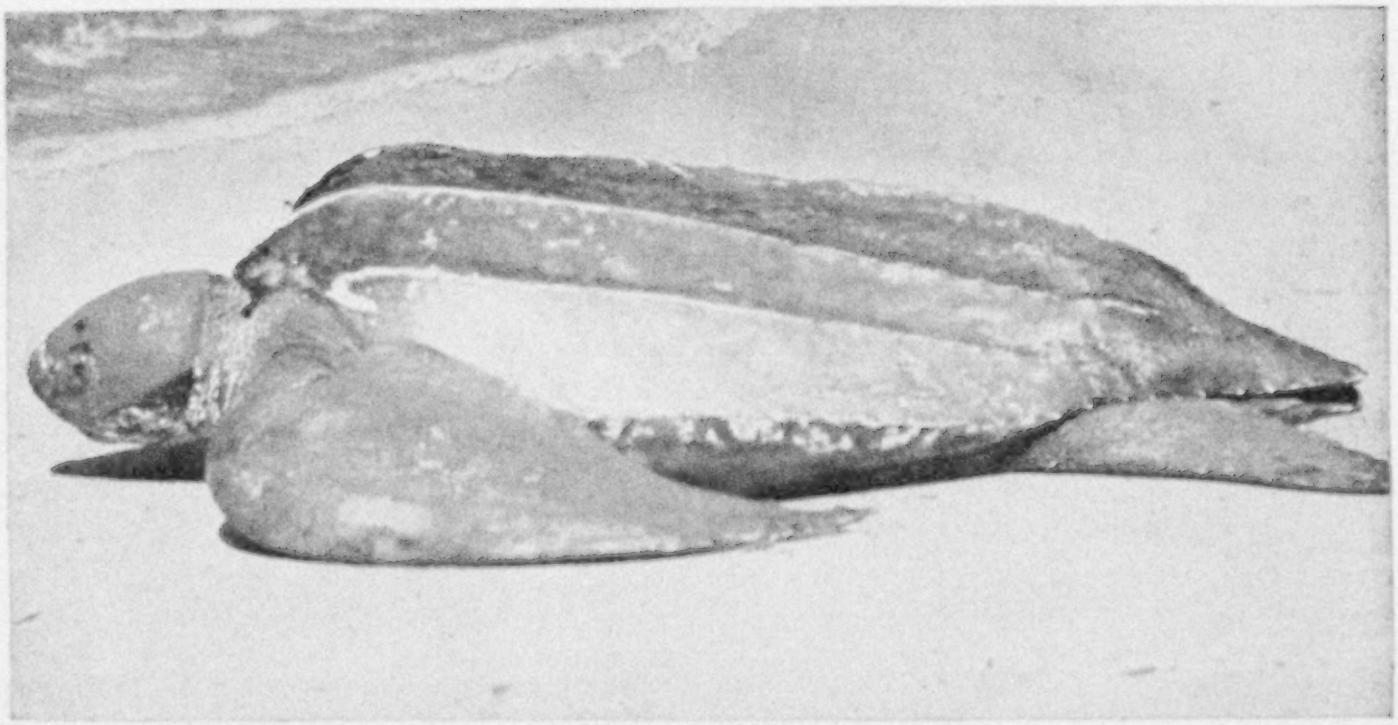
Mr. Lorenze Hagenbeck informs the writer that he shot a 30-foot gavial with a body fully three feet in diameter. The striking feature about the gavial is the structure of the head. From in front of the eyes the snout extends forward in such slender fashion it might be compared to an enormously elongated, duck-like bill. A photograph of this important reptile is presented on page 614.

The salt-marsh crocodile of Malaysia



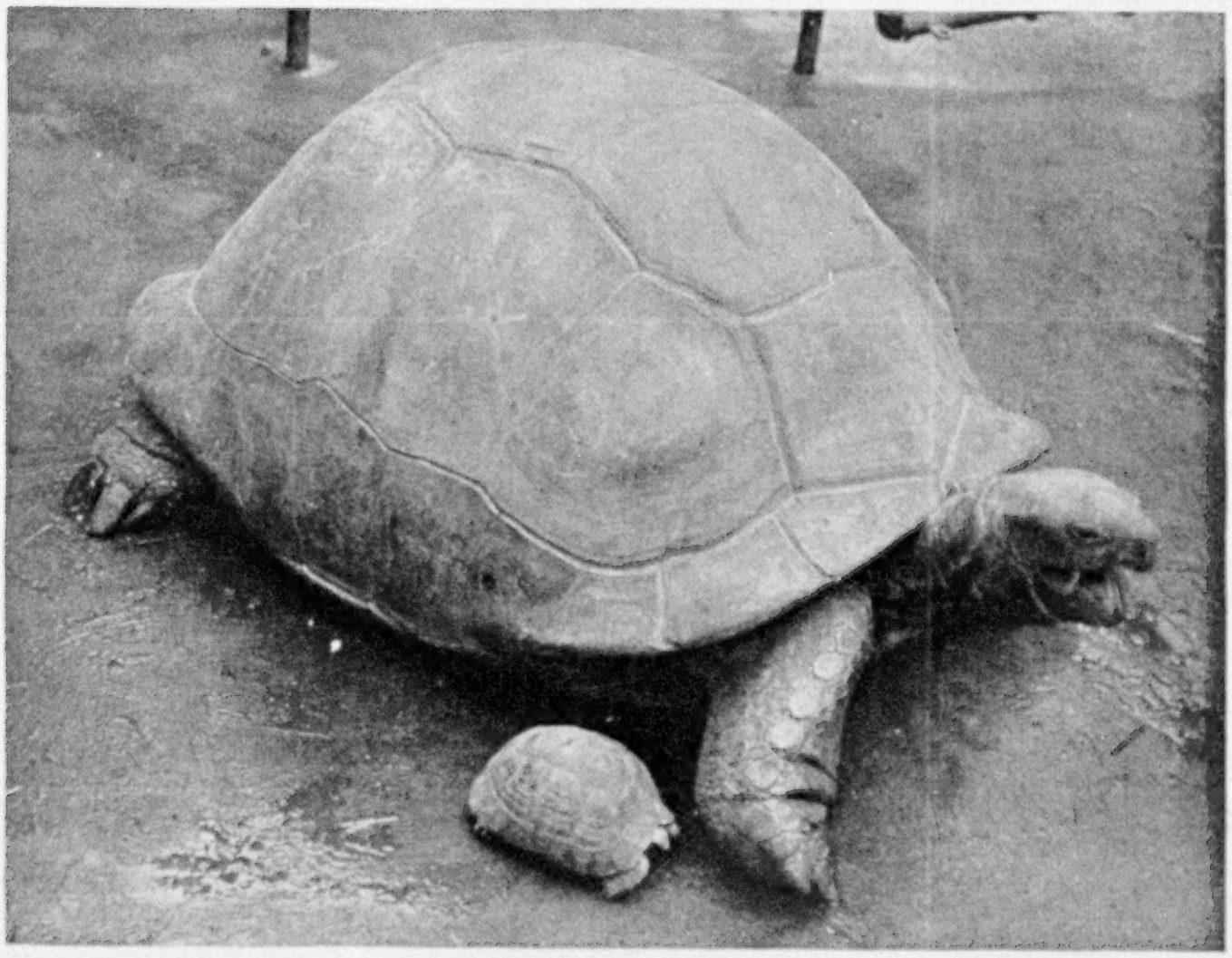
SNAKE-NECKED TURTLE (*Chelodina longicollis*): AUSTRALIA

The serpentine neck is too long to be tucked back into the shell. When the animal is frightened a portion of the neck is folded sideways along the inner margin of the shell (see page 609). Photo by Raymond L. Ditmars.



LEATHERY TURTLE (*Sphargis coriacea*): TROPICAL SEAS

This sea giant is by far the largest of the turtles. There are records of 1,000-pound specimens. It appears to be the survivor of an ancient group of reptiles. Photo by Raymond L. Ditmars.



GIANT TORTOISE (*Testudo elephantina*): ALDABRA ISLANDS

A number of species of gigantic tortoises inhabit miniature archipelagoes in the Indian and Pacific oceans. These island monsters appear to be survivors of ancient races of reptiles. Photo by Raymond L. Ditmars.

is another monster reptile, attaining a length of 20 feet. Together with the Nile crocodile, it has a bad reputation regarding the destruction of human life. The American species appear to be inoffensive, though some grow to huge proportions. In captivity, however, they become bold by constantly observing the presence of their keepers, and are liable to attack a man without warning.

Attaining the greatest bulk of any of the modern reptiles, the crocodilians have been alleged to grow very slowly and reach remarkable ages. Judging from observations that have been made in the reptile-house of the New York Zoological Park, the growth of alligators and crocodiles is quite rapid. Some alligators hatched in the building increased from a length of seven inches to the substantial size of over eight feet within a period of eight years.

THE TORTOISES AND TURTLES

Made up of 11 families, 52 genera, and over 225 species, the turtles and tortoises form another order of the reptiles of quite direct, ancient lineage. There is no great degree of specialization to be noted among these creatures with the exception of the marine species, which, having taken to the sea, have undergone a modification of the limbs, these having developed into flippers.

Strangest among the tortoises and turtles, and appealing to some students as the strangest of all the reptiles, are the gigantic tortoises inhabiting small

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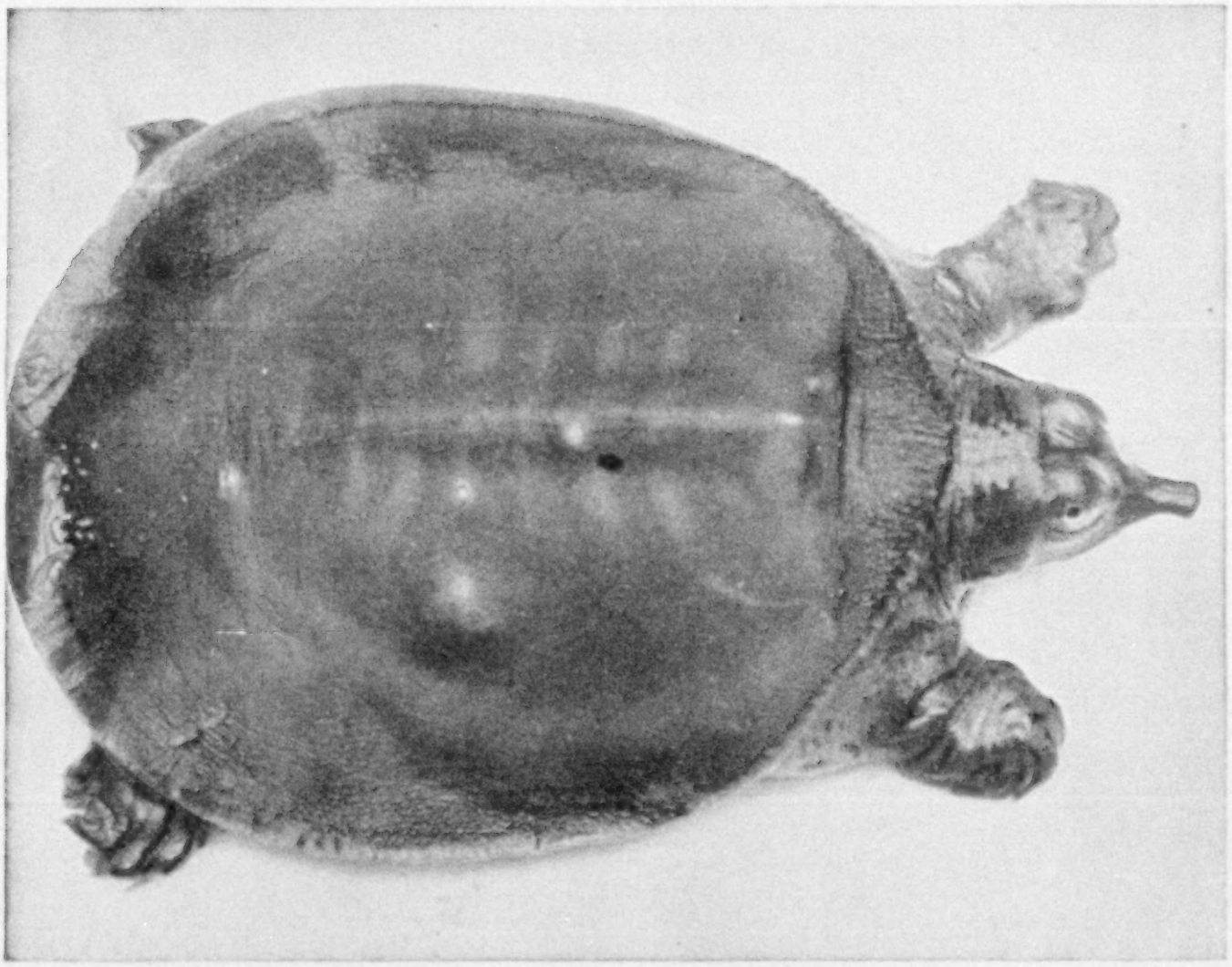


SOFT-SHELLED TURTLE (*Trionyx ferox*): SOUTHERN UNITED STATES

Despite its soft shell, the species is by no means defenseless. Provided with keen and powerful mandibles, it deals a bite with the rapidity of a serpent's stroke. A big specimen weighs 40 pounds. The species is edible (see page 609). Photo by Raymond L. Ditmars.

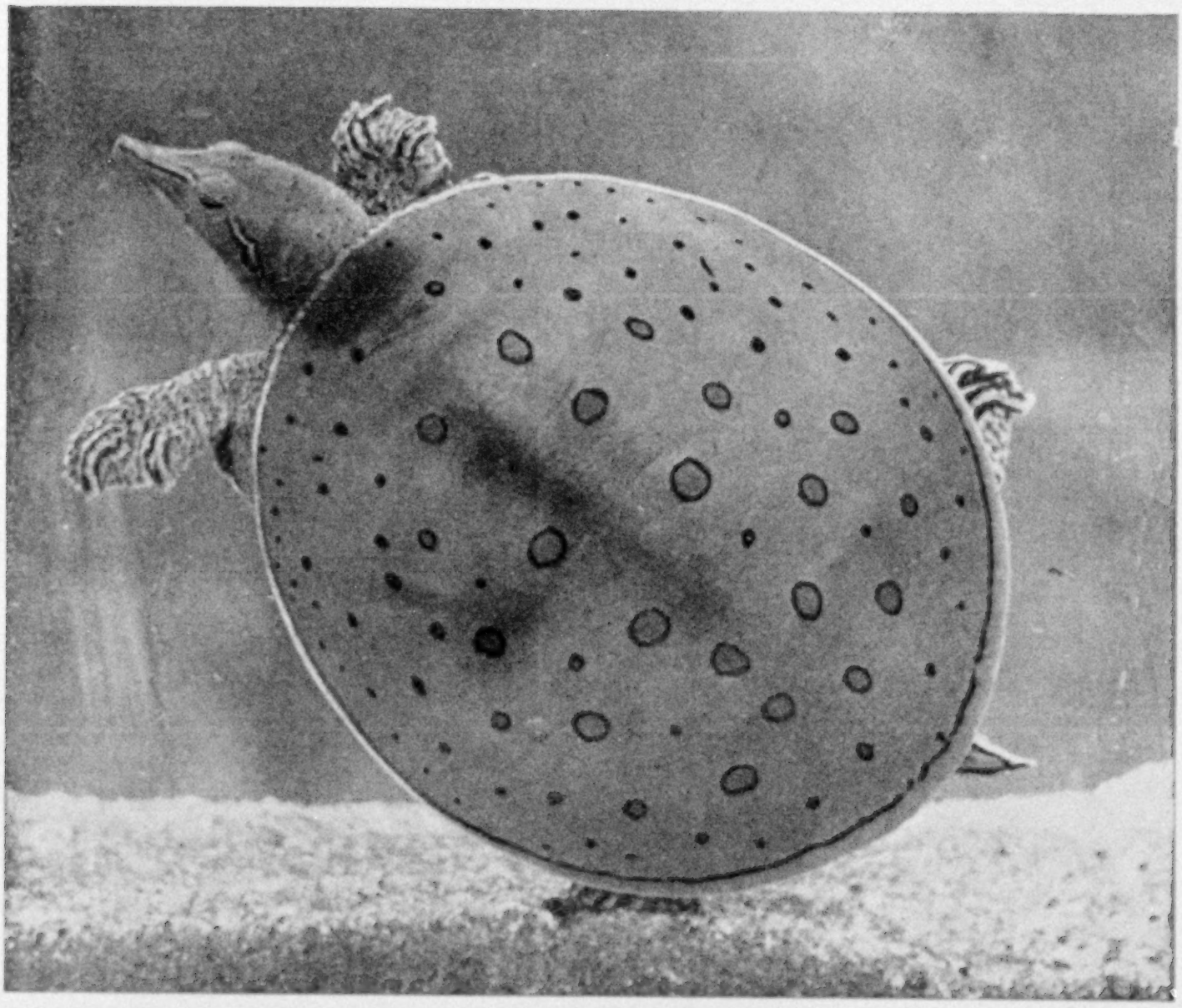
isolated groups of islands in the tropical Pacific and the Indian Ocean. Though the crocodilians and the great sea turtles outclass the present creatures in weight, the latter are, in comparison to other tortoises, of astonishing proportions.

As fossils of closely related species are found on the various continents far north and south of the *habitat* of the survivors, it is reasonable to assume that the races of great tortoises of these miniature tropical archipelagoes have passed through ages when volcanic disturbances shattered great portions of the globe and numerous scaled and plated monsters degenerated and perished.

In an accompanying photograph the reader may compare one of these island patriarchs with a modern tortoise of average size. Six species of the giant tortoises inhabit the Galapagos Islands, which are about 500 miles west of the South American coast and about under the Equator; they occur nowhere else in the New World (see page 607).

The Aldabra Islands, in the Indian Ocean, form the *habitat* of four other species, and four species are also found in the Mauritius-Rodriguez group. A number of expeditions have been dispatched to the colonies of these interesting animals and they are rapidly nearing extinction in a wild state.

Among the freaks of the members of the turtle and tortoise order are the matamata and the snake-necked turtle. The former is found in Brazil and the Guianas. It has a broad, low shell and



SOFT-SHELLED TURTLE (*Trionyx spinifer*): MISSISSIPPI VALLEY

With the young specimens the leathery shell is brightly marked. All of the species of *Trionyx* are edible; this also relating to the cartilaginous "shell." Photo by Raymond L. Ditmars.

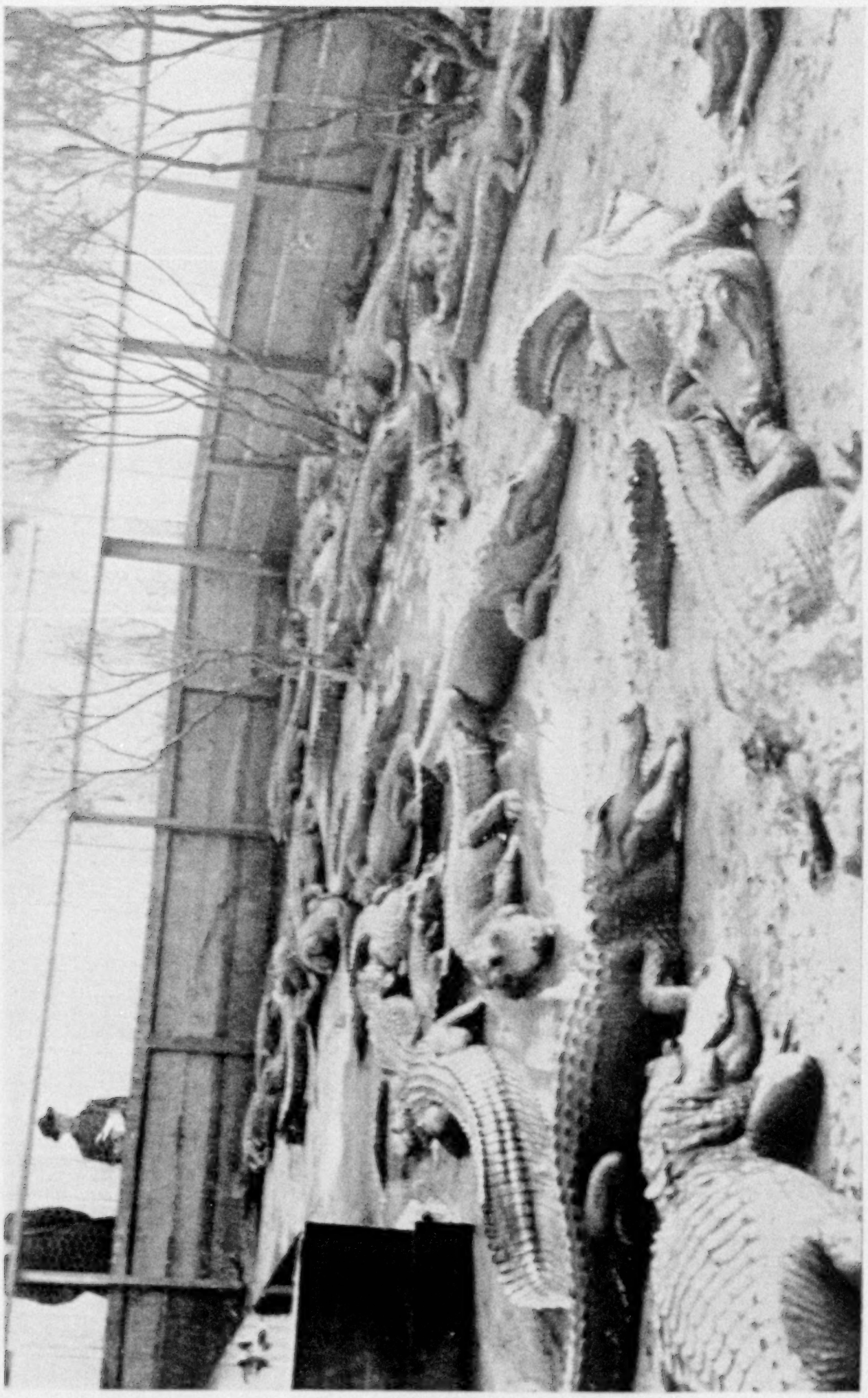
a head and neck so wide and flat that these members look as if pressed out between rollers. In line with this grotesque structure there is a coarse, ragged fringe on the neck, the snout is provided with a tubular appendage, and the eyes are as small as pinheads. This creature attains a weight of 40 pounds. The habits are in keeping with its ugly looks.

Australia and New Guinea form the home of the eccentric snake-necked turtle. The serpentine neck is so long that the creature must double it back in lateral curves in order to draw the head within protection of the shell. This operation throws the head to one side. The characteristic has been responsible for another popular name—the "side-necked" turtle (see page 606).

Not far behind the two mentioned species in eccentricity of development are the soft-shelled turtles. About 15 species are known, forming the family *Trionychidæ*. The New World species are confined to North America. They are strictly aquatic and prefer muddy rivers. The shell is soft and leathery with flabby border, but these turtles are by no means defenseless, as the jaws are powerful and provided with knife-like

Photo by Gilbert H. Grosvenor

A PILE OF YOUNG ALLIGATORS, TWO TO FOUR YEARS OLD, AT THE ALLIGATOR FARM, ST. AUGUSTINE



SOME OF THE BIG FELLOWS AT THE ALLIGATOR FARM, ST. AUGUSTINE, FLORIDA Photo by Gilbert H. Grosvenor

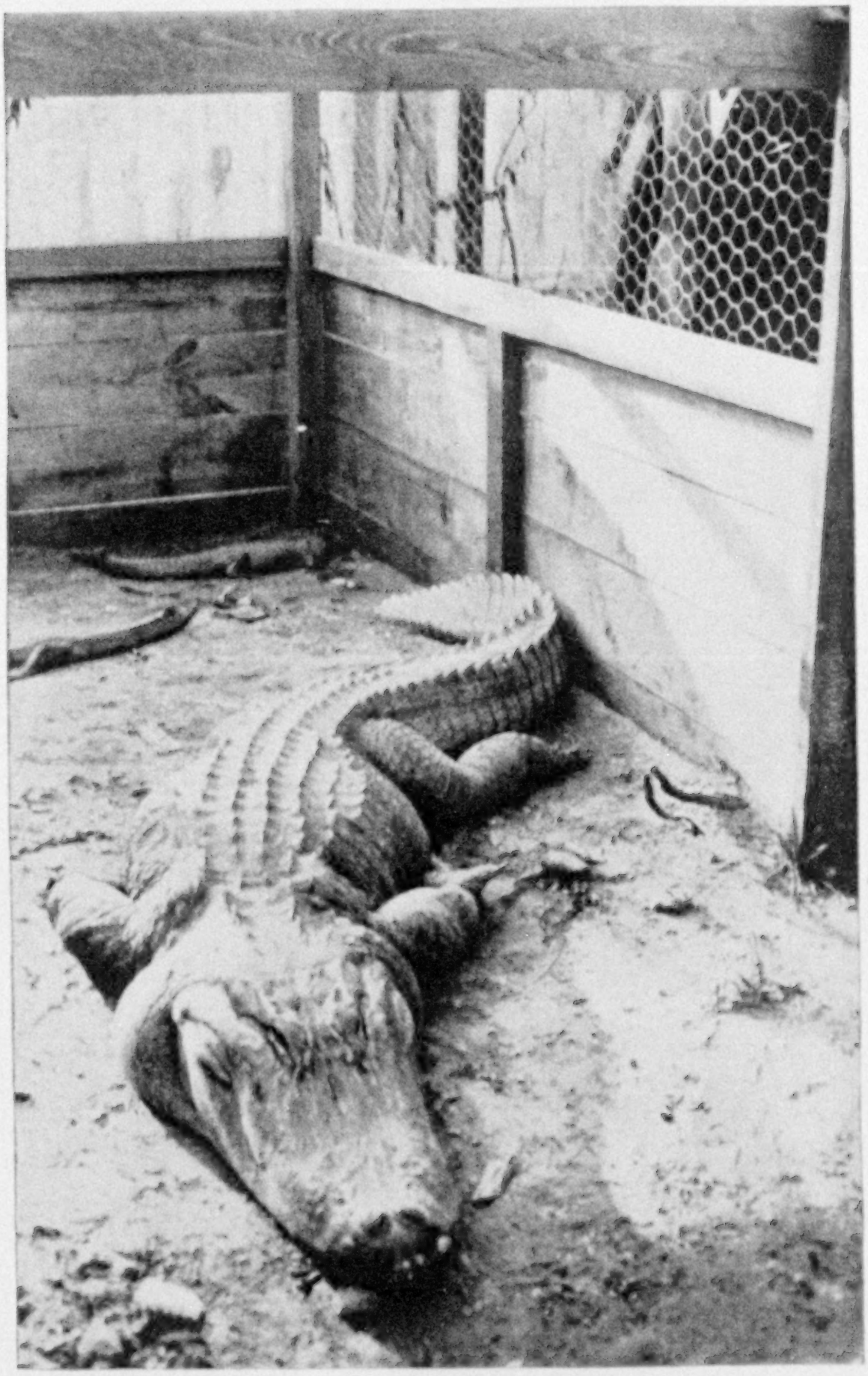


Photo by Gilbert H. Grosvenor

THE KING OF THE ALLIGATOR FARM: ITS AGE IS A DEBATABLE QUESTION

cutting edges. They bite with the rapidity of a serpent's stroke, and a three-foot specimen can amputate a man's finger.

Soft-shelled turtles are good eating and to cook them is not difficult. As the shell itself is edible, the entire animal goes into the frying-pan with no other preparation than cleaning. The negroes appropriately call the small examples "flap-jack" turtles. Very young specimens are beautifully marked and in the water look like variegated leaves (see pages 608 and 609).

THE LIZARDS

The lizards form the largest order of reptiles. They are particularly interesting as representing the ancestral forms of the serpents. All stages of limb development are to be noted, from the powerful runners and jumpers to species wholly destitute of limbs, that glide like serpents, and other diminutive legless forms that are blind and burrow deep into the soil like earthworms. The immediate relationship between lizards and snakes is strongly evident by the possession among a number of the less specialized serpents of well-developed (internal) hind limbs, which are actually functional. Among the lizards, habits run riot, and among the members of this order Nature has seen fit to lavish the most brilliant colors.

A grand chart showing the geographical distribution of lizards would demonstrate that these reptiles require a greater degree of heat than the turtles or the snakes. They abound in the equatorial latitudes and are but sparingly distributed in the temperate zones. The comparatively very small number of species that occur north or south of the tropics are of small size and quite uniform development. As with the serpents, several families are cosmopolitan. The extensive distribution of the members of genera, however, is particularly marked among the lizards.

Largest among the lizards are the members of a small family—the monitors, genus *Varanus*. There are 27 species, occurring in Africa, India, Malaysia, and Australia. Some of them reach a length of 8 feet and a weight of 60 pounds. All are fleet and powerful, fierce and carnivorous (see page 619).

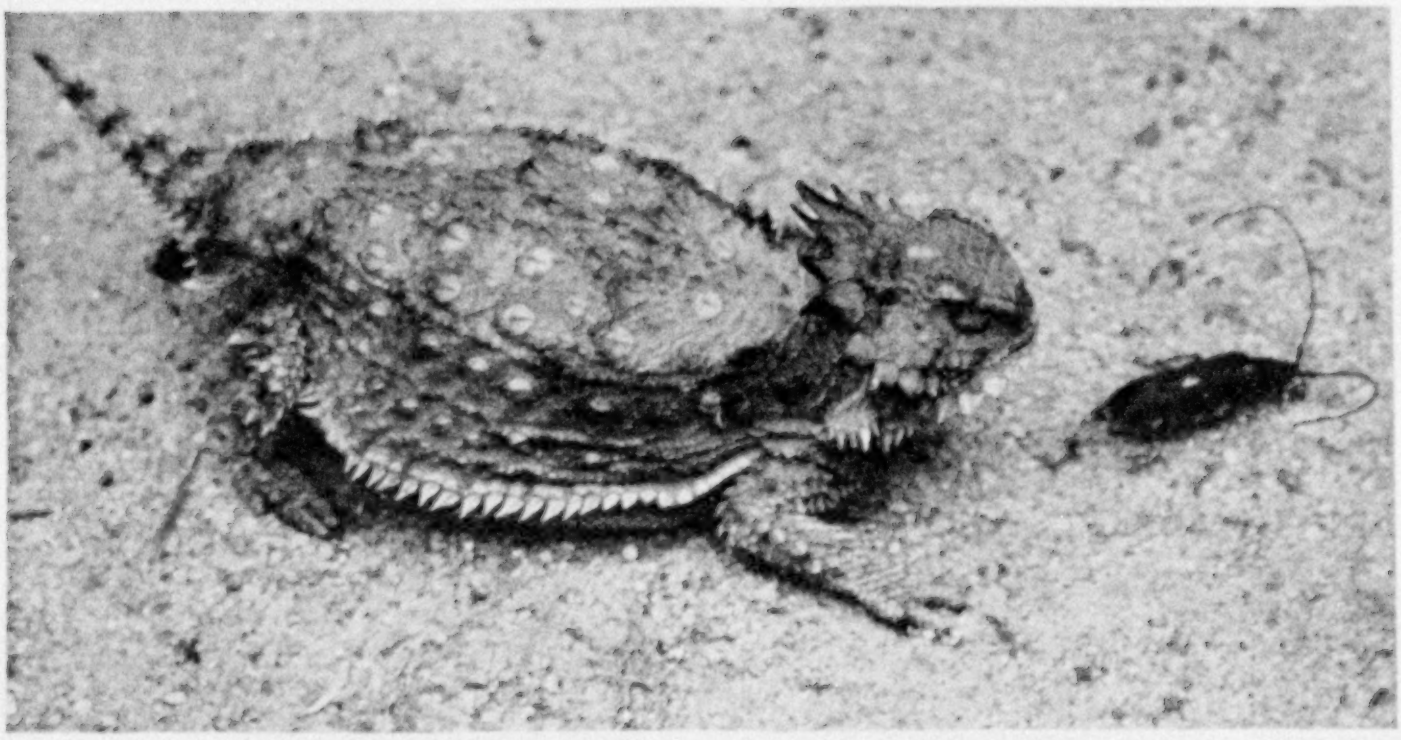
Largest of the living lizards is the Malayan kabara-goya of the Singhalese. This powerful brute attains a length of 8 feet. It frequents the jungles, and many tiger hunters have been startled by the rush of a big monitor, the reptile making as much noise as some big hoofed animal as it tears its way through the undergrowth away from danger. The feeding habits are typical of all the members of the genus.

The method of attacking a small animal more closely resembles the actions of members of the cat tribe than of a reptile. Rushing at its ill-fated prey, the monitor shakes it in the same violent fashion as a terrier treats a rat. If the animal's struggles become so violent that there is a possibility of it escaping, the lizard holds it to the ground under its long claws—as long as those of a leopard. Then the jaws take a better hold.

When the prey is killed it is tossed about in the jaws until the head points down the lizard's throat. It is then gulped down entire, when the monitor wipes the jaws with the enormously long, forked tongue. A kabara-goya can swallow a whole pigeon.

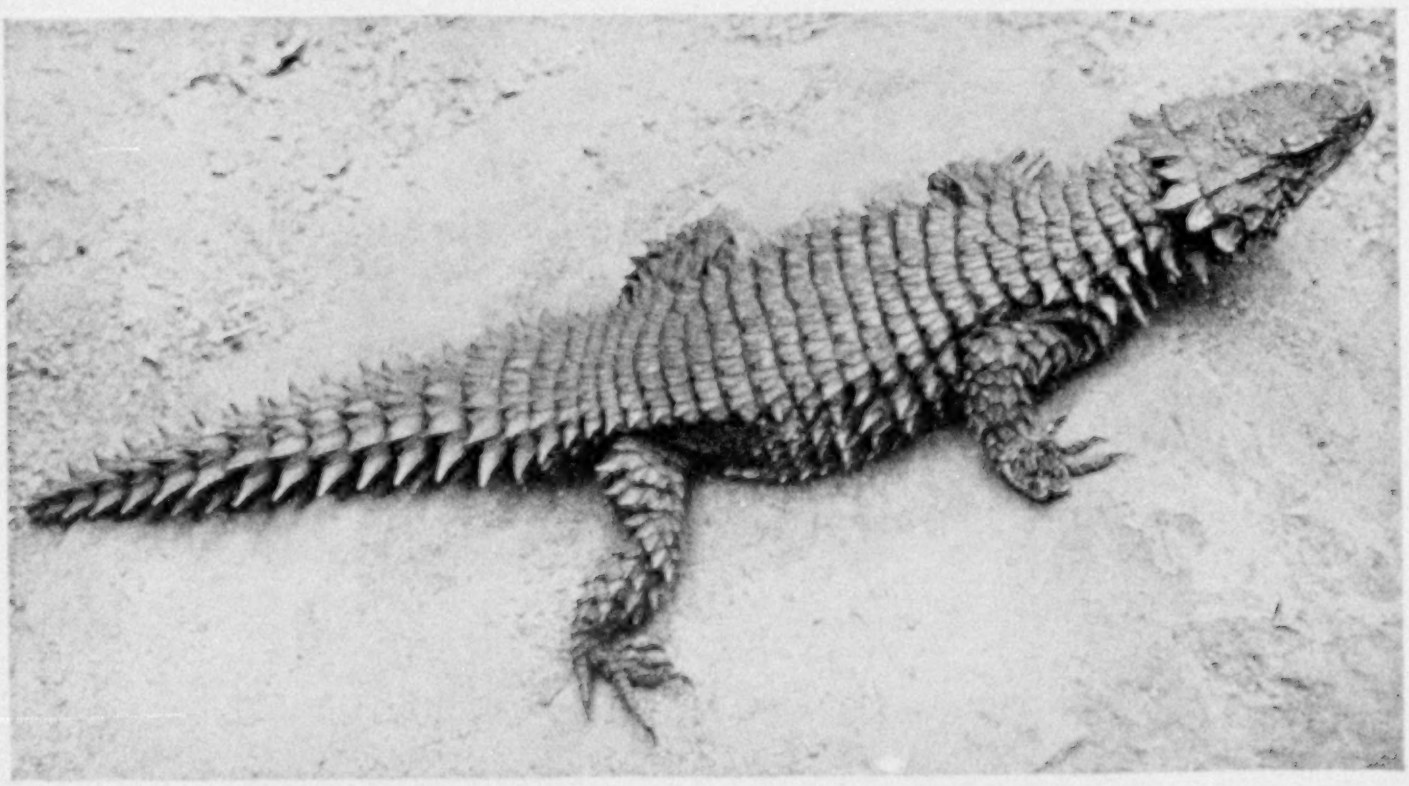
The species is fond of eggs, and one of the sights of a reptile-house is the feeding of the larger monitors. From 8 to 10 hen's eggs are taken at a meal. The eggs are swallowed without breaking the shell and with such rapidity they click against each other in passing down the throat. Digestion is rapid. Within 24 hours the gastric juices have disintegrated the shells and the fragments of these are entirely dissolved.

A monitor of smaller size inhabits the borders of the Sahara Desert. It is of pallid hue, to match the sterile soil; this coloration also relating to the eyes, which, with their staring black pupil, gives the animal a fierce appearance. As if determined to possess some added feature in its makeup, the desert species startles the intruder by widely opening its jaws



HORNED LIZARD (*Phrynosoma regale*): ARIZONA (SEE PAGE 616)

The horned "toads," more properly called the horned lizards, inhabit the desert regions of the United States and Mexico. Sixteen species are recognized. Photo by Raymond L. Ditmars.



SPINY LIZARD (*Zonurus giganteus*): SOUTH AFRICA

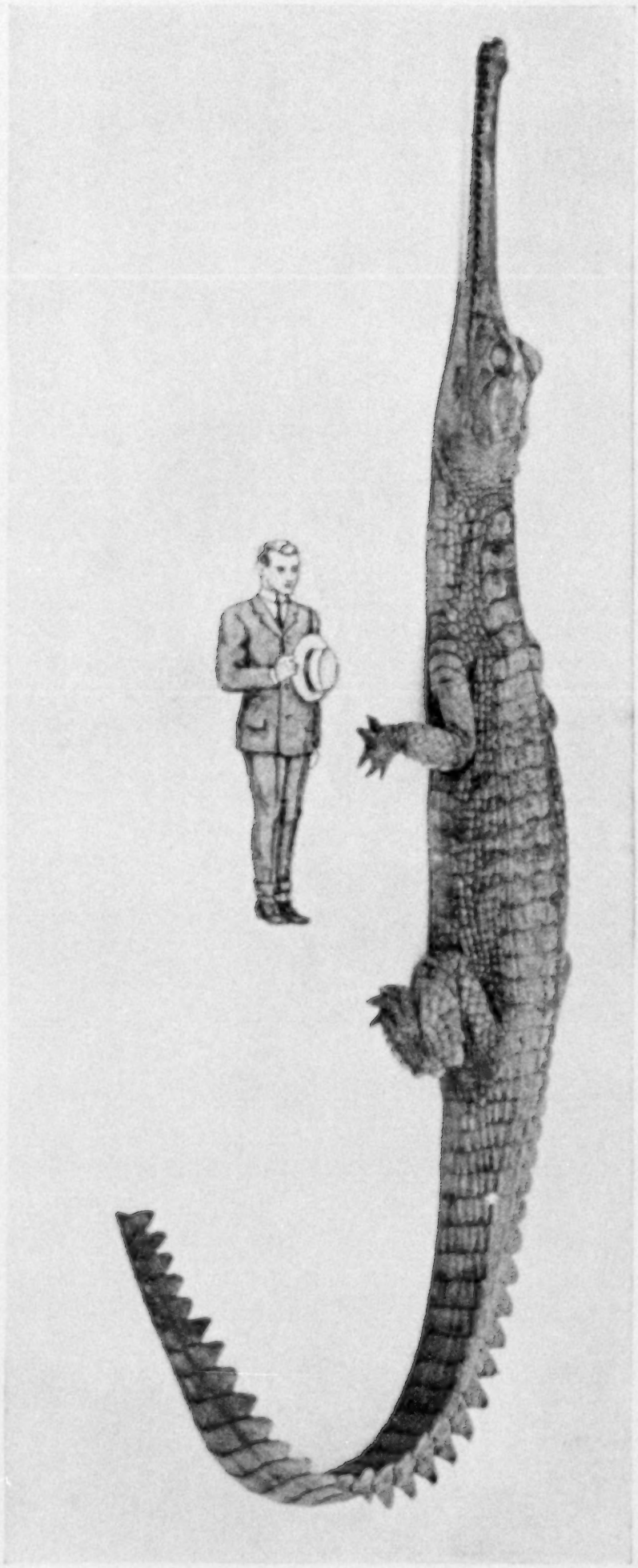
Found in dry, rocky places. A big specimen is 15 inches long. Photo by Raymond L. Ditmars

when disturbed, thence disclosing the fact that the mouth parts are as black as if steeped in ink.

Other big lizards are the iguanas, belonging to a New World family that contains both large and small members. Differing from the monitors, the iguanas are omnivorous, and so decorated with spines and protuberances that some of them appeal to the novice like the subjects of a disordered dream. The South American iguana attains a length of six feet and is a wild-looking creature, owing to a high crest of lance-like dorsal spines. It is largely herbivorous, but does not hesitate to rob the nests of small birds or dig into a rotting log for insect prey.

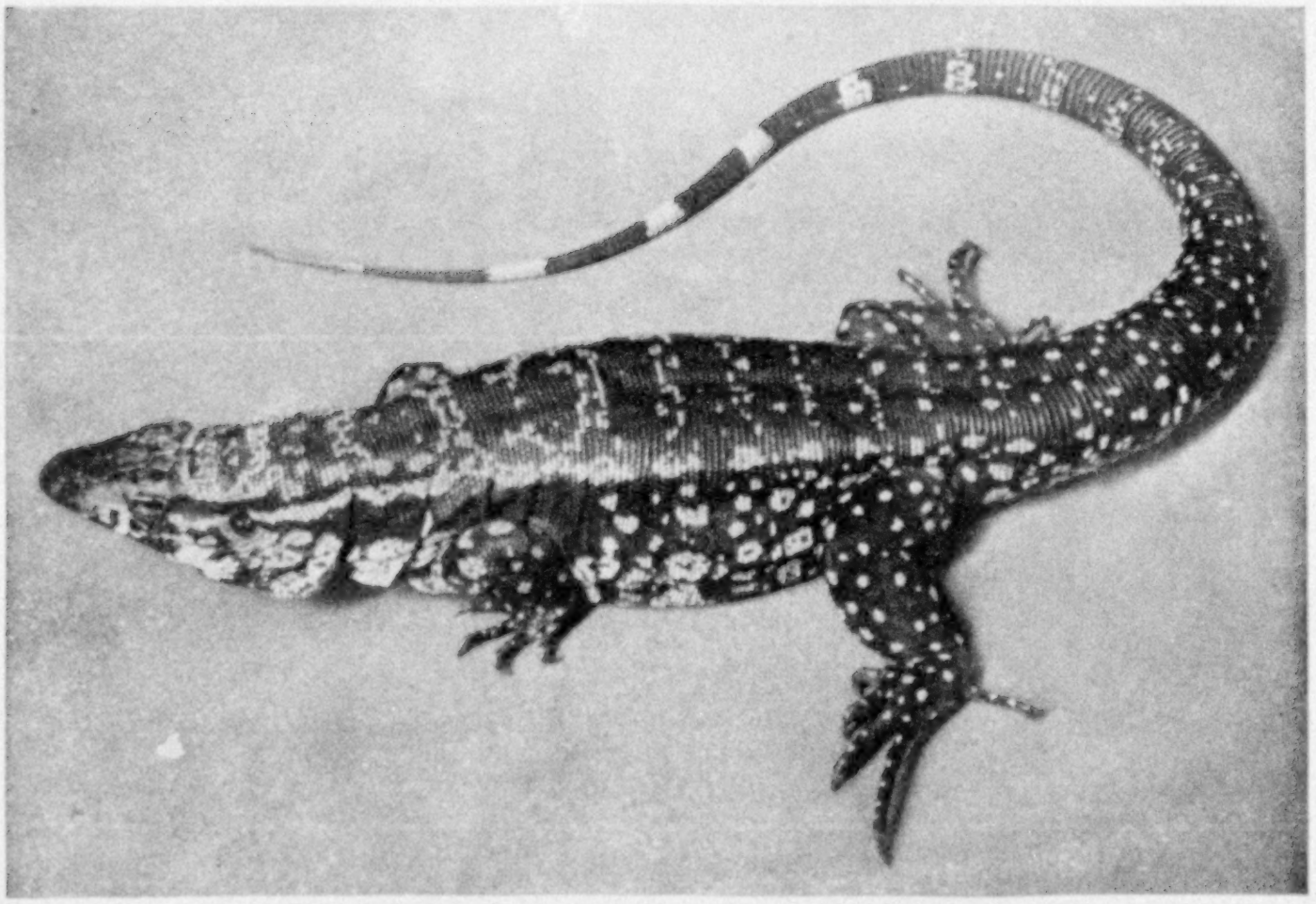
This lizard is edible and subjected to a cruel process in the South American markets, where its flesh is described as much like that of a young fowl. The tip of the longest toe on each hind foot is caught with a pair of pliers and the tendon stretched from the toe itself. By means of the stretched tendons the hind feet are tied together, rendering the lizard helpless.

As an illustration of the tenacity with which reptiles cling to life, it may be mentioned that iguanas are shipped to animal dealers in the United States bound in the manner described, and, though without food or water for weeks, they run about soon after being liberated, and will live for years—this despite the fact that they come from the tropics infested with ticks and other parasites.



A GAVIAL (*Gavialis gangeticus*) COMPARED TO A 6-FOOT MAN; INHABITS THE GANGES

Attains the greatest bulk of any of the modern reptiles. It has been recorded 30 feet long (see page 605)



BLACK TEGU (*Tupinambis nigropunctatus*): GUIANAS AND BRAZIL

The length of a big specimen is three feet. Tegus are carnivorous and often destructive to poultry. Photo by Raymond L. Ditmars

A batch of iguanas from Dutch Guiana were the means of nearly depopulating the reptile-house in the New York Zoological Park. An almost microscopic parasite spread from these lizards among other exhibits of their kind, thence among the serpents. A great number of valuable specimens died from the severe inflammation following the bites of the tiny pests that swarmed in masses that looked like a sprinkling of coarse, red dust. The original hosts suffered little inconvenience. The parasites themselves defied disinfecting and general painting of cages.

The epidemic came to as abrupt a termination as its startling beginning. From the writer's observations he is led to believe that a fungus attacked the invaders, and we have Nature to thank for the close of a situation that threatened to render the reptile-house untenable.

THE HORNED TOADS THAT SPIT BLOOD

Various members of the *Iguanidæ* are characterized by their droll form or decoration of colors. The horned "toads" belong to this family. These squatty lizards are anything but toad-like in habit, as they inhabit the hot wastes of the desert and run with the speed of the wind (see page 614).

Occasional specimens evince a startling habit of squirting a stream of blood from the eyelid. A Mexican specimen about four inches long gave a fine demonstration of this puzzling habit while being photographed and measured in the writer's laboratory. A pair of shining calipers seemed to greatly excite the lizard. It puffed up its body, the eyes bulged, when a jet of blood as fine as a hair shot a distance of fully five feet, spattering the wall with a shower of tiny drops.

FLYING DRAGON (*Draco volans*): MALAYSIA

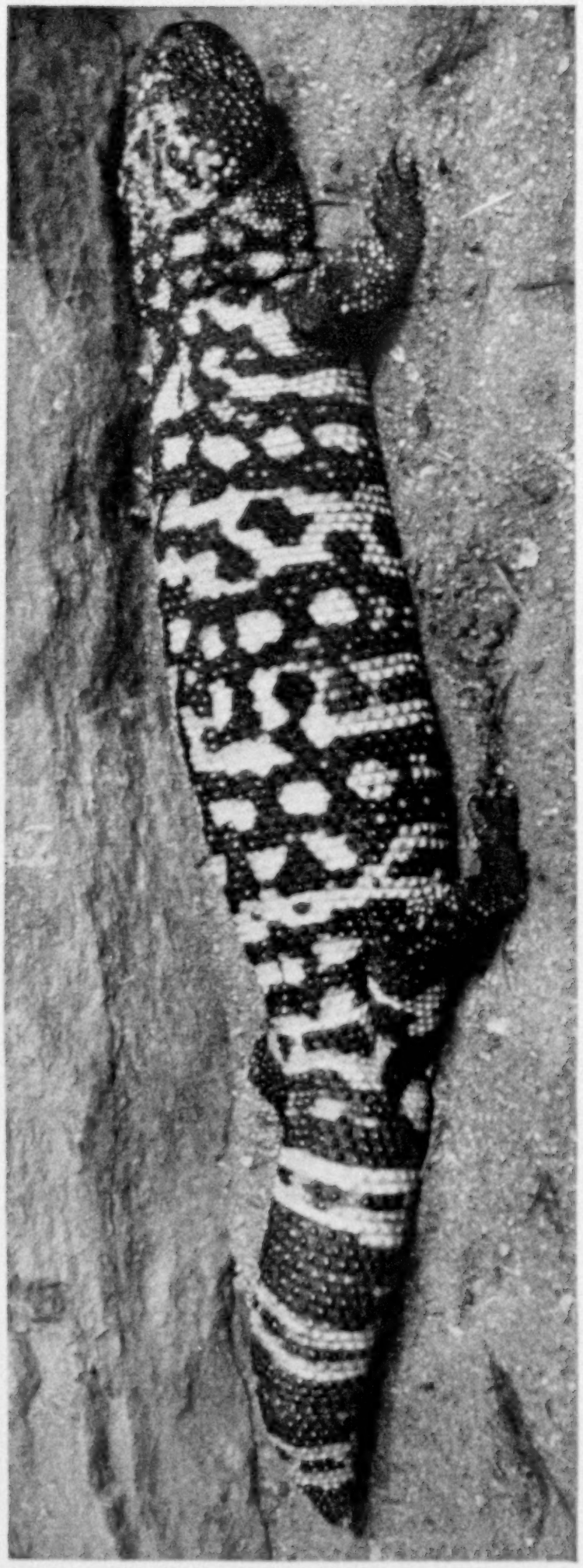
By means of elongated, movable ribs the several species of this genus are able to spread a membraneous skin and glide from tree to tree. They do not actually fly. The "wings" of some of the species are brightly colored. Photo by Raymond L. Ditmars.

It has recently been alleged that a small parasite is responsible for this habit. It is thought that a mite causes blisters about the eye, which burst and produce a hemorrhage as the lizard puffs up in angry fashion when handled.

For variability of form the lizards of both the Old and New World stand about equal. A unique development exists among the members of an Old World family, which, possessing enormously elongated ribs covered with dilatable skin, are able to spread these membranes and sail in parachute-like fashion from tree to tree.

The geckos, which are cosmopolitan, have an adhesive pad on each toe, and are able to run inverted on horizontal surfaces with the agility of a fly.

Some of the African desert lizards are



GILA MONSTER (*Heloderma suspectum*): SOUTHWESTERN UNITED STATES

This and another species of the same genus are the only known poisonous lizards. The fangs are grooved and in the lower jaw, and the venom is secreted in the salivary glands. The bite is not so dangerous as that from a venomous snake. Photo by Raymond L. Ditmars

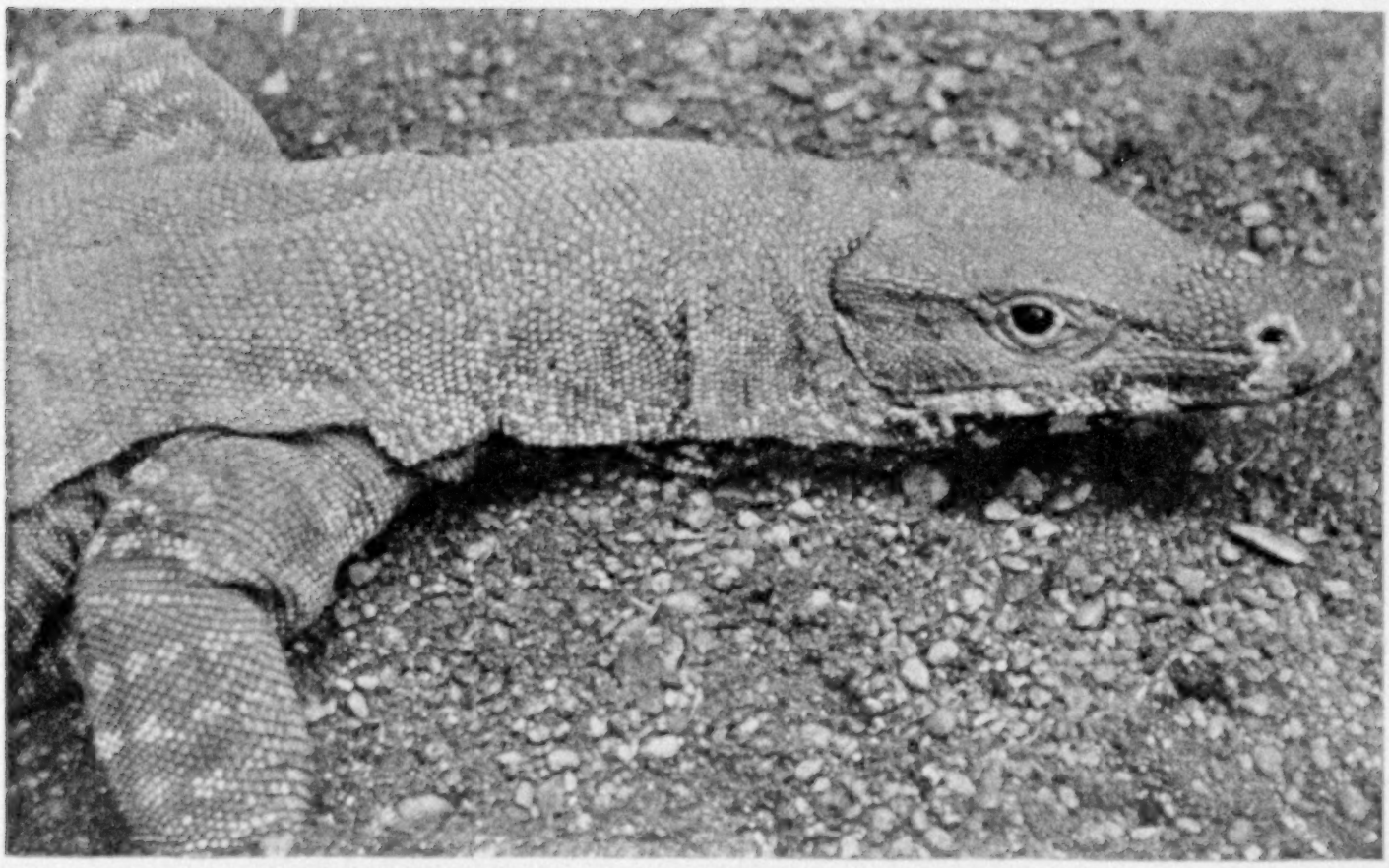
provided with such tiny and almost useless limbs that when frightened they fold these members against the side of the body and literally swim out of sight in the yielding sands.

Unlike the members of the other orders of reptiles, few lizards have become even semi-aquatic. None is strictly aquatic—a condition rendering the order of lizards unique among reptiles.

In the southwestern part of the United States and similar desert regions of Mexico are found the only known *poisonous* lizards, two in number, forming a family by themselves. The more northerly species is popularly known as the Gila monster. It is stout of body, with a short, thick tail. The venom-conducting teeth are in the lower jaw, and the poisonous secretion is much like that of the venomous serpents. Its chemical properties, however, are not so powerful as the virus of snakes, although this lizard must be rated as highly dangerous to man. Captive examples become so tame they may be handled without exhibiting any symptoms of biting. The specimens in the Zoological Park subsist entirely upon raw eggs.

SNAKES

Snakes are the most widely distributed of the reptiles. They range far beyond the lizards into the temperate regions. In North America serpents extend well into Canada. In the boreal regions of the Old World they extend northward to the latitude



MONITOR (*Varanus gouldi*): AUSTRALIA

Among the monitors are the largest known lizards. An Indian species grows to be eight feet long. The monitors are strictly carnivorous, fierce and active (see page 613). Photo by Raymond L. Ditmars.

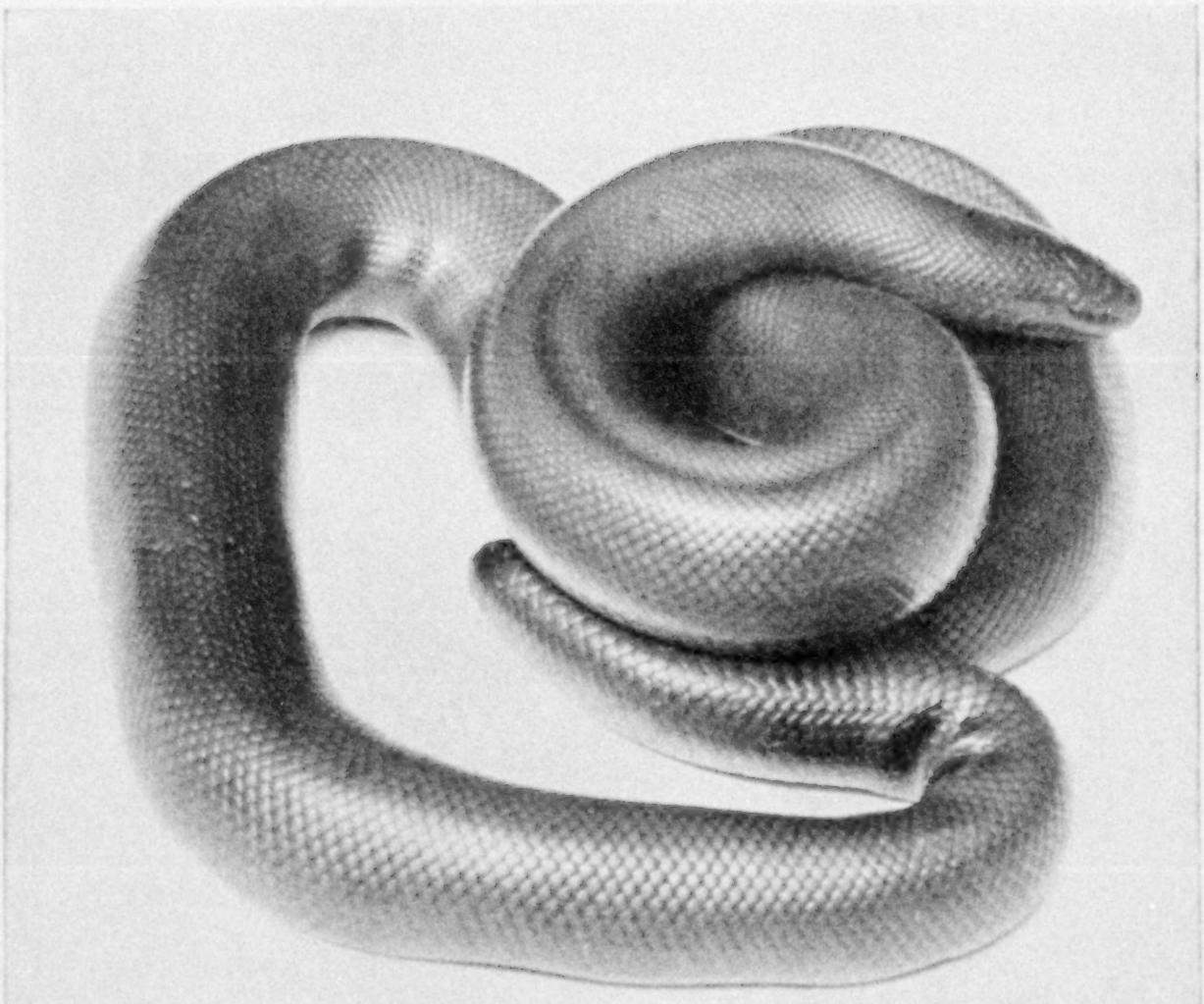
of Iceland. Serpents range in size from the burrowing species of five inches and a body not thicker than a goose-quill to the great pythons, which attain a length of 30 feet and a weight of 300 pounds.

A great proportion of the snakes have become highly specialized. It is among these so-called lowly creatures that we find the most extraordinary and deadly weapons for the purpose of killing the prey that are possessed by any of the vertebrates.

Popular interest is always strong regarding serpents of great size. All of the very large serpents are members of a single family, the *Boidæ*. None is poisonous, and the members of this family kill their prey by constriction—squeezing it to death. In the New World the great constrictors are called boas; they are generally known as pythons in the Old World. There is little structural difference between a boa and a python. One of the characteristics about the members of the *Boidæ* is the protrusion of a pair of internal hind limbs in the shape of stout spurs at the vent. This condition shows the immediate relationship between the serpents and the lizards.

The largest known serpent occurs in the Malay Peninsula, Java, Borneo, and Sumatra. This is the regal or reticulated python. It attains a length of 30 feet. Second in size is the Indian python, inhabiting the Indian Peninsula, Indo-China, the Malay Peninsula, and Java. This constrictor grows to be 25 feet long and is very abundant. The South American anaconda is a close third, and the African python ranks fourth in size. The latter snake appears to attain a maximum length of 18 feet. The dimensions given of these giant serpents are considerably in excess of the average (see pages 630 and 632).

Few regal pythons over 22 feet long are nowadays brought out of Malaysia.



RUBBER BOA (*Charina bottæ*): CALIFORNIA

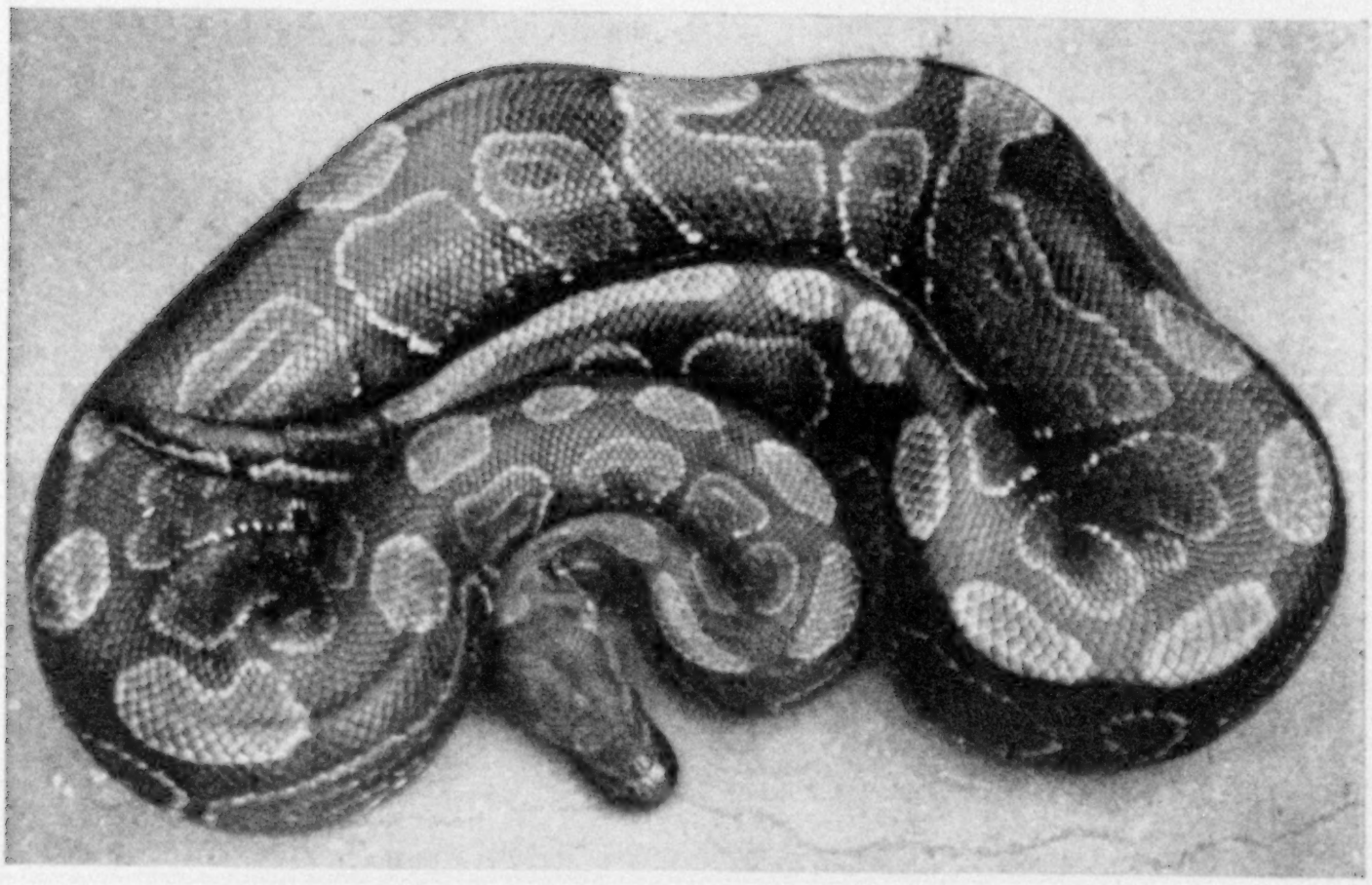
A diminutive, burrowing representative of the family of great constrictors. It ranges farther from the equator than any other species of the *Boidæ*. Photo by Raymond L. Ditmars.

A snake of this size will weigh, if in well-nourished condition, about 225 pounds. In the wilds these big serpents feed largely upon wild swine. In captivity they prefer pigs to any other diet. They normally feed at about 10-day intervals.

Species of the genus *Boa* inhabiting tropical America attain a maximum length of 12 to 14 feet. They are richly colored and, together with smaller examples of the Indian constrictor, *Python molurus*, are in much demand among the circuses for "snake-charming" exhibitions. The method of procedure with the circus enchantress is considerably different from the tactics of the Hindu snake "charmer", but in neither exhibition is hypnotism employed, nor are the snakes drugged, as is often alleged. The circus snake-charmer employs a batch of tame constrictors that have not the least objection to being handled, while the Hindu, to the contrary, keeps his snakes wild and excitable, as will be later explained when we consider the poisonous snakes.

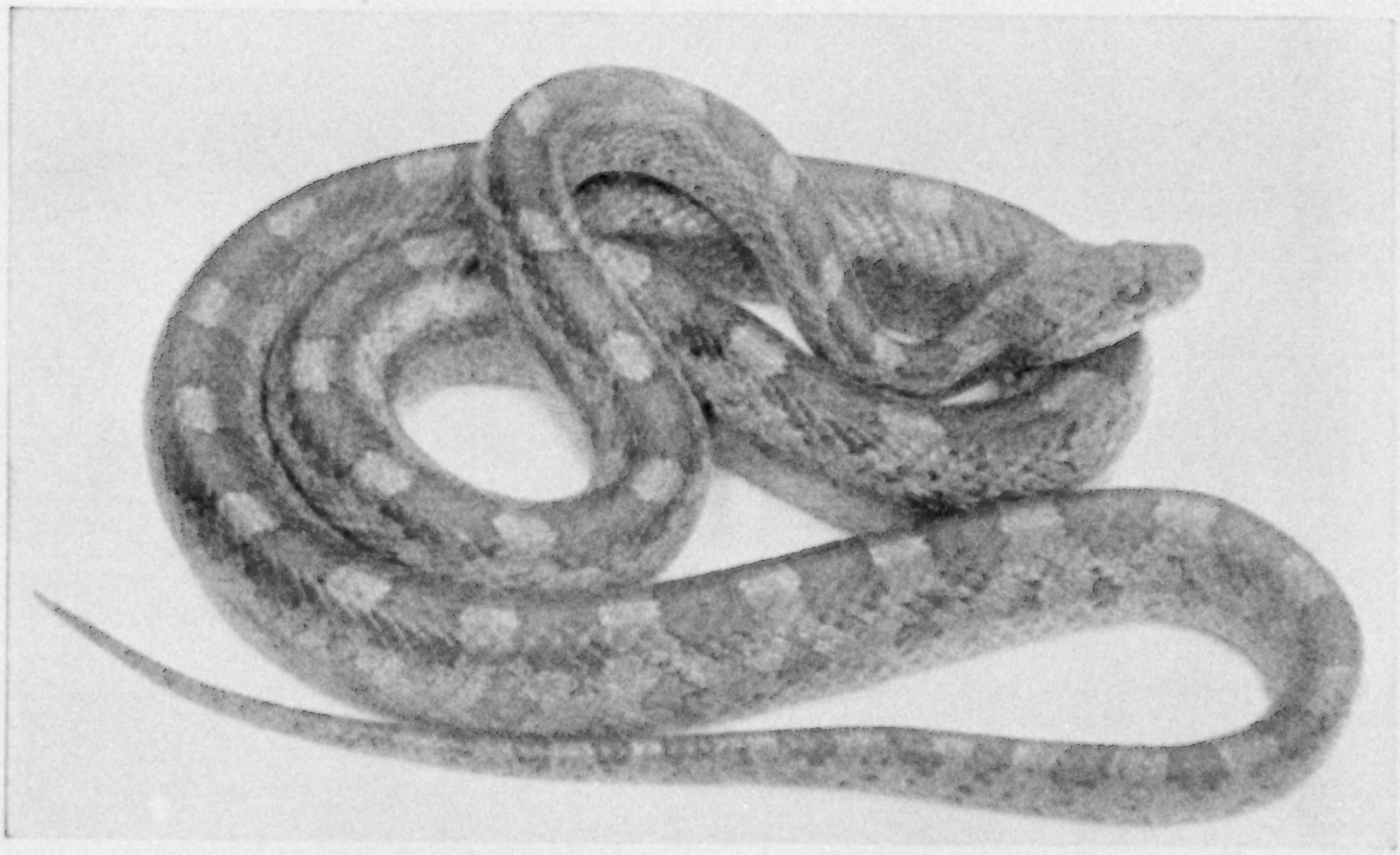
SOME SNAKES ARE USEFUL

Throughout the temperate and tropical regions of the globe are species of serpents of high economic value. These are mostly the members of the largest family of snakes, the *Colubridæ*. The greater number of the non-venomous serpents belong to this family. Our familiar black snake and king snake are members of this family. In some parts



BALL PYTHON (*Python regius*): AFRICA

This small python seldom attains a length of over five feet. It receives the name from a habit of coiling up into a veritable ball. Photo by Raymond L. Ditmars

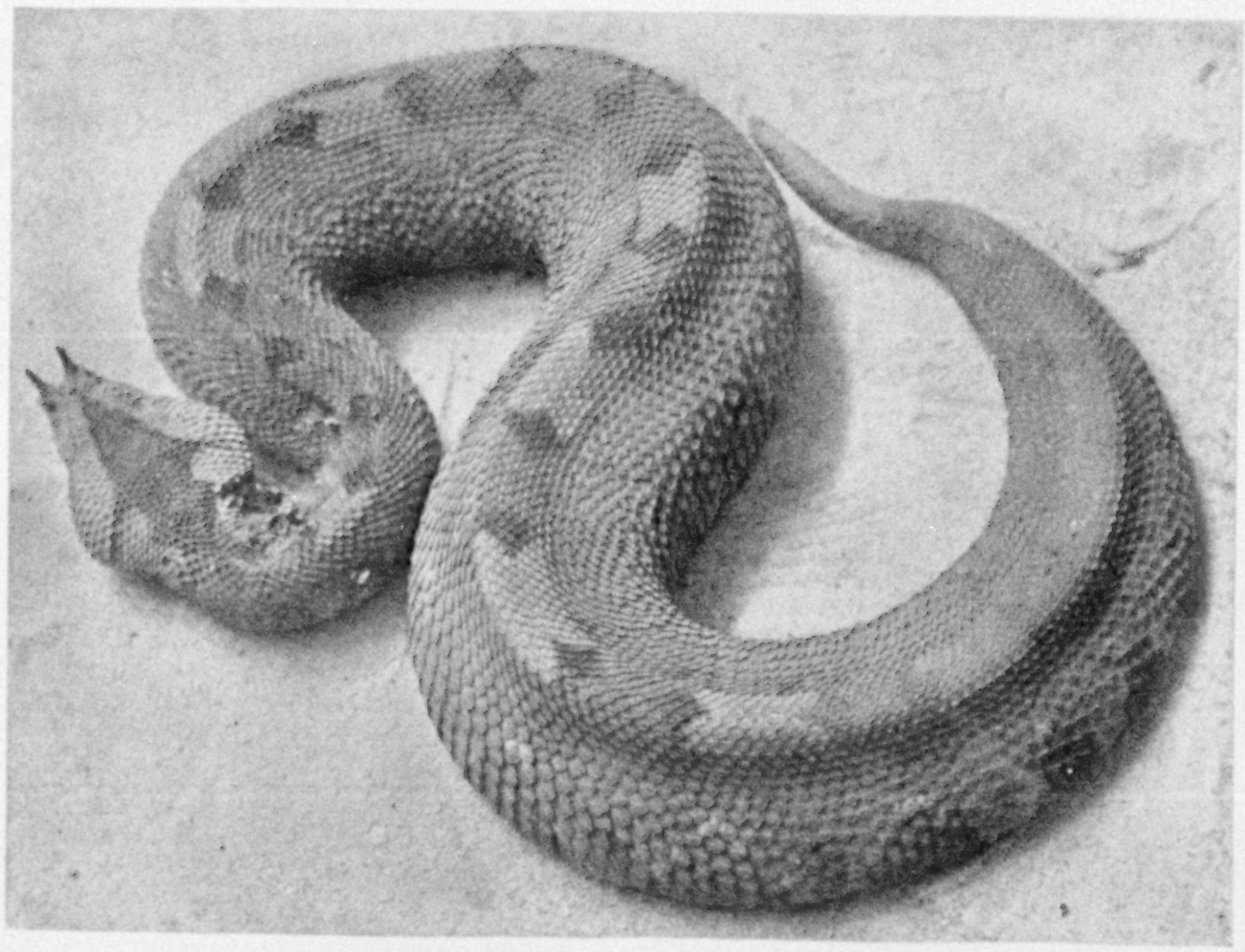


RAT SNAKE (*Coluber emoryi*): SOUTHERN UNITED STATES

This serpent receives its name from its habit of preying largely upon rodents. A great number of the snakes are thus of economic value, but a foolish prejudice is rapidly exterminating some of the most useful specimens (see pages 620 and 623). Photo by Raymond L. Ditmars.

THE POISON-SPITTING BLACK COBRA, RINGHALS (*Sepedon hæmachates*): SOUTHERN AFRICA (SEE PAGE 624)

Very dangerous, owing to a habit of spitting its venom to a distance of several feet. The Boers call it the Ringhals from the broad white bands that show on the neck when the hood is expanded. Photo by Raymond L. Ditmars.



RHINOCEROS VIPER (*Bitis nasicornis*): WEST AFRICA (SEE PAGE 631)

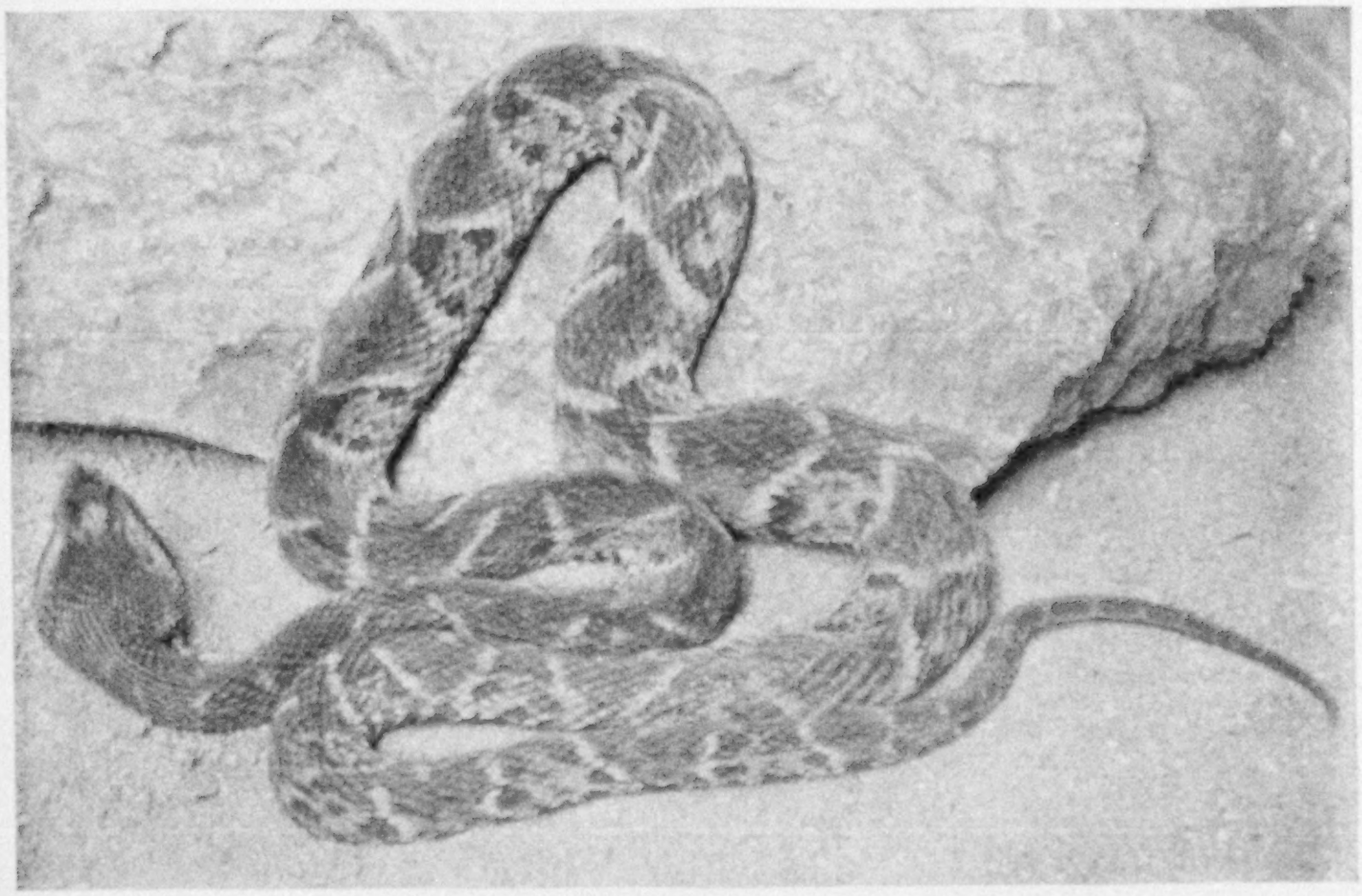
Most beautifully colored of the poisonous snakes, but the bright hues are soon dimmed after the skin is shed by the reptile's habit of entering the water. On account of its semi-aquatic habits it is also called the river jack. Photo by Raymond L. Ditmars.

of the world the rodent-eating species are protected by law. Distributed throughout India is a large and active species known as the rat snake. Its useful habits are recognized in many areas. This is likewise the case with a closely related species found throughout tropical America. The creole French call the latter the cribo, and in the coastal regions, where the bubonic plague has appeared, there is a fine imposed for the killing of rat-eating snakes.

The farmers of our western States are now beginning to realize the useful habits of several species of serpents, and the writer has received letters from widely scattered areas asking about the possible propagation of a large plains reptile—the bull snake, *Pituophis sayi*.

Queerly enough we find some of the deadliest known serpents belonging to the same family as the non-venomous species. The Indian Ocean and the waters of the tropical Pacific are inhabited by a great number of wholly aquatic, veritable sea serpents that possess deadly fangs and sometimes swim in schools of countless thousands. These snakes have a paddle-like tail to assist them in swimming. They range in size from a yard to eight feet in length, and the greater number of them are vividly ringed; a few are longitudinally banded. The marine snakes form a subfamily that may be designated as a specialized offshoot of the great family containing the harmless serpents, the *Colubridæ*.

Another offshoot is the subfamily con-



FER-DE-LANCE (*Lachesis lanceolatus*): SOUTH AMERICA AND THE LESSER ANTILLES

(SEE PAGE 633)

A big "lancehead" is six feet long. The fangs are enormously developed and the bite of this snake is usually fatal unless the most approved remedies are at hand. Injections of an anti-venomous serum has been found to be most practical. The fer-de-lance is greatly feared on the sugar-cane plantations. Photo by Raymond L. Ditmars.

taining the formidable cobras and their allies. The members of this important subfamily are treacherously deceptive in appearance. Here we have an admirable illustration of how incorrect it is to believe a poisonous snake may be told by the possession of a heart-shaped head. A number of the most deadly known snakes belong to this subfamily.

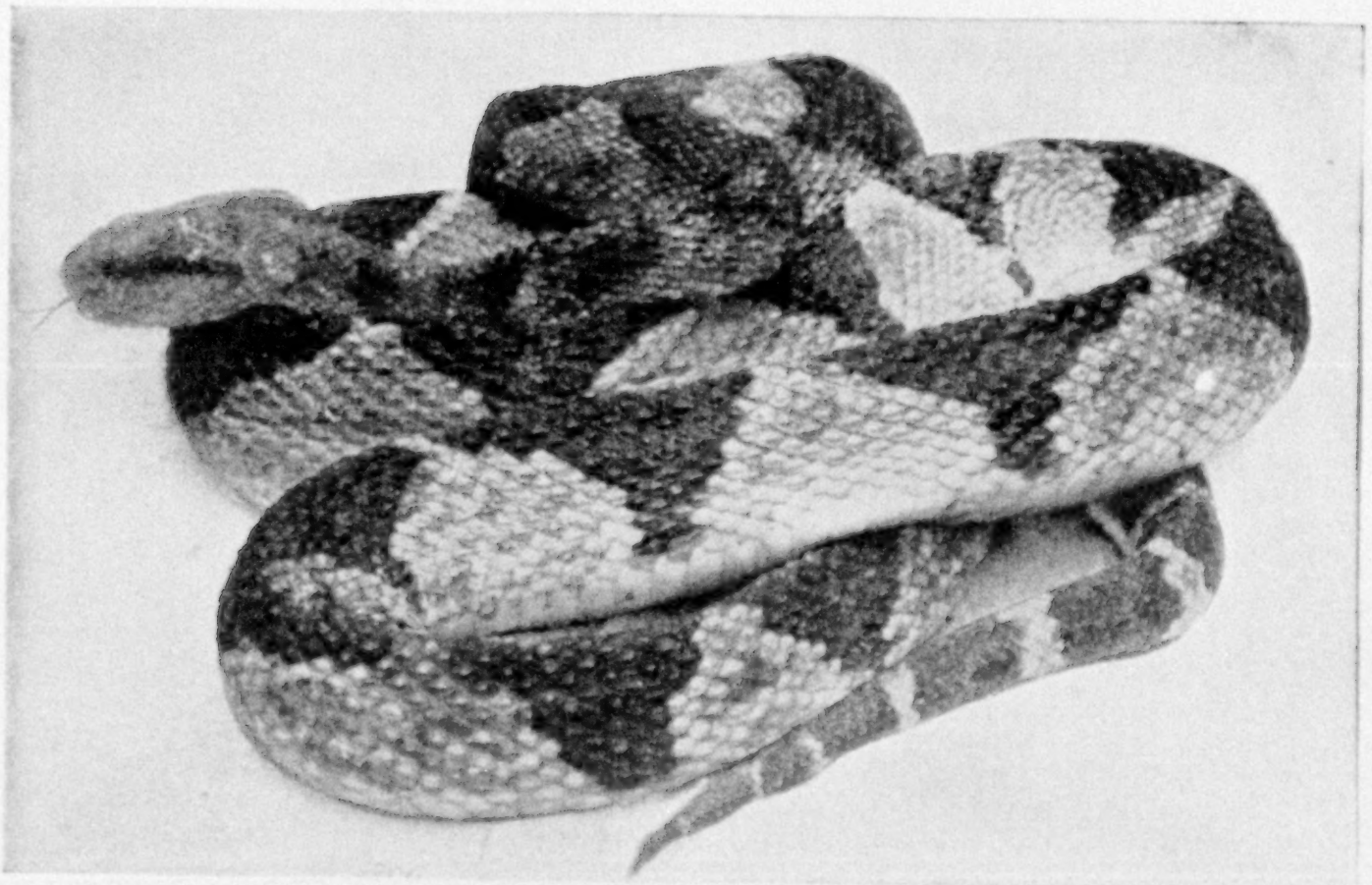
The most diabolical in temper and terrible of them all is as innocent looking in bodily makeup as the typical and harmless snakes.

The New World is singularly free of such reptiles, a single genus representing the subfamily. India, Malaysia, and Africa are infested with these elapine snakes. The headquarters, however, are in Australia and New Guinea. There they constitute the great majority of serpent life. These are the only regions of the world where poisonous reptiles predominate.

Most spectacular of the elapine serpents are the cobras, or "hooded" snakes. The genus *Naja*, of India, Malaysia, and Africa, contains 10 of these reptiles, of which the most conspicuous is the Indian or spectacled cobra. Members of several allied genera rear the body from the ground and spread the neck in similar fashion.

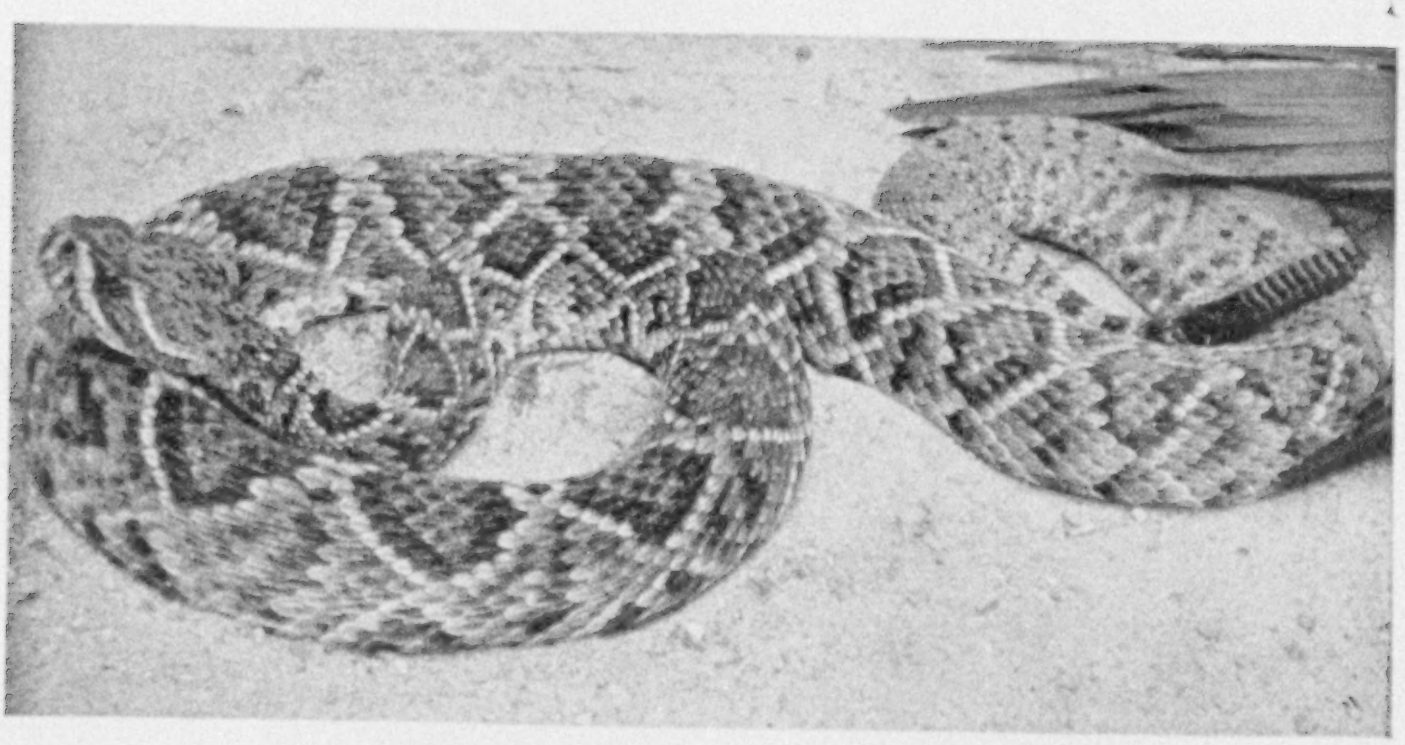
THE POISON-SPITTING SNAKE

Some of the African cobras display a dangerous habit of spitting poison at the intruder. The ringhals, genus *Sepedon*, of southern Africa, is a pitchy black, exceedingly vicious cobra that receives its name from one or two broad white



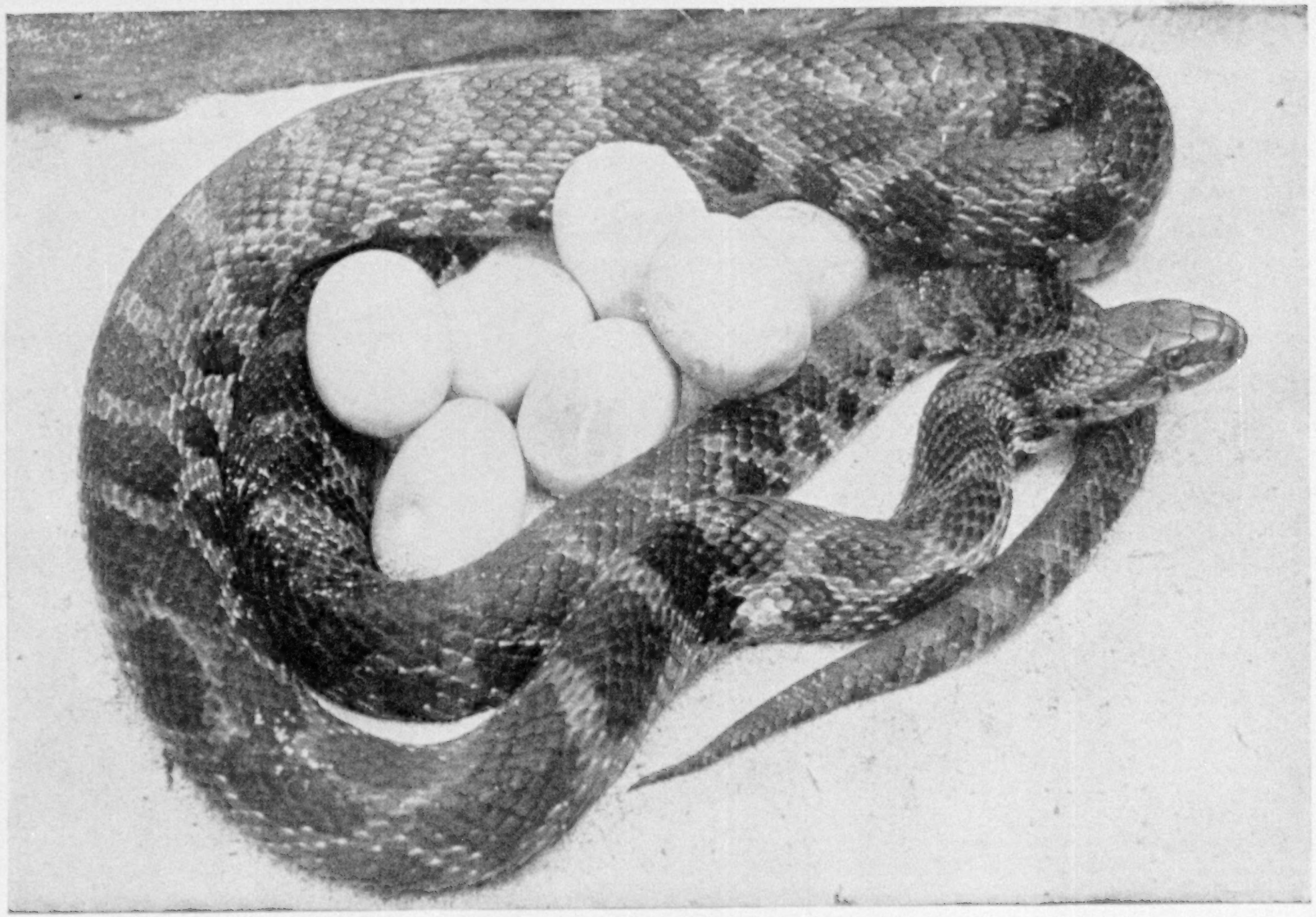
BUSHMASTER (*Lachesis mutus*): TROPICAL AMERICA

Largest and most dangerous of the venomous serpents of the New World. Twelve-foot specimens have been recorded. Contrary to the habits of all other viperine snakes, it brings forth its young from eggs, which are deposited in damp places. Photo by Raymond L. Ditmars.



DIAMOND-BACK RATTLESNAKE (*Crotalus adamanteus*): SOUTHEASTERN UNITED STATES

Largest and most deadly of the venomous serpents of the United States. It attains a length of eight feet, and must be rated among the most dangerous known snakes (see page 633). Photo by Raymond L. Ditmars.



FOX SNAKE (*Coluber vulpinus*) AND HER EGGS: CENTRAL UNITED STATES

The female snake remains coiled about the eggs a day or so after they are laid. Then she leaves them without further attention to hatch in about eight weeks' time. The eggs are laid under big stones or logs. Photo by Raymond L. Ditmars

bands that show on the neck when the snake is reared in fighting pose. As the snake arches its neck to glare at the intruder it is liable to eject fine jets of poison for a distance of six to eight feet. These deadly streams are dangerously well aimed.

The poison is ejected by contracting the lower jaw in such a fashion that the permanently erect fangs overlap it. At a movement of the adversary the reptile arches the neck to a degree that throws the head backward, bringing the tips of the hypodermic teeth to bear. The muscles over the poison glands are then contracted and a thin stream of venom leaves each fang. The observer is liable to receive the deadly stream directly in the eyes, and the amount of poison expended is surprising.

The writer has seen the entire lower part of a large glass panel peppered with tiny drops. When photographing or watching the antics of snakes of this kind, the writer wears a pair of auto goggles to protect his eyes. In obtaining the photograph of a ringhals which is published herewith, the front of the camera was well spattered with tiny drops of poison, as the snake became infuriated at the movements of the writer's hands in focusing.

It was this type of reptile that Colonel Roosevelt refers to in his "African Game Trails." The author says: "At this camp we killed five poisonous snakes—a light-colored tree snake, two puff adders, and two seven-foot cobras. One of the latter three times 'spat' or ejected its poison at us, the poison coming out from the fangs like white films, or threads, to a distance of several feet. A few years ago the singular power of this snake, and perhaps of certain other African species, thus to eject the poison at the face of an assailant was denied by scientists; but it is now well known. Selous had already told me of an instance which came under his own observation, and Tarlton had once been struck in the eyes and for a moment nearly blinded by the poison. He found that to wash the eyes with milk was of much relief."

THE COBRAS OF THE HINDUS

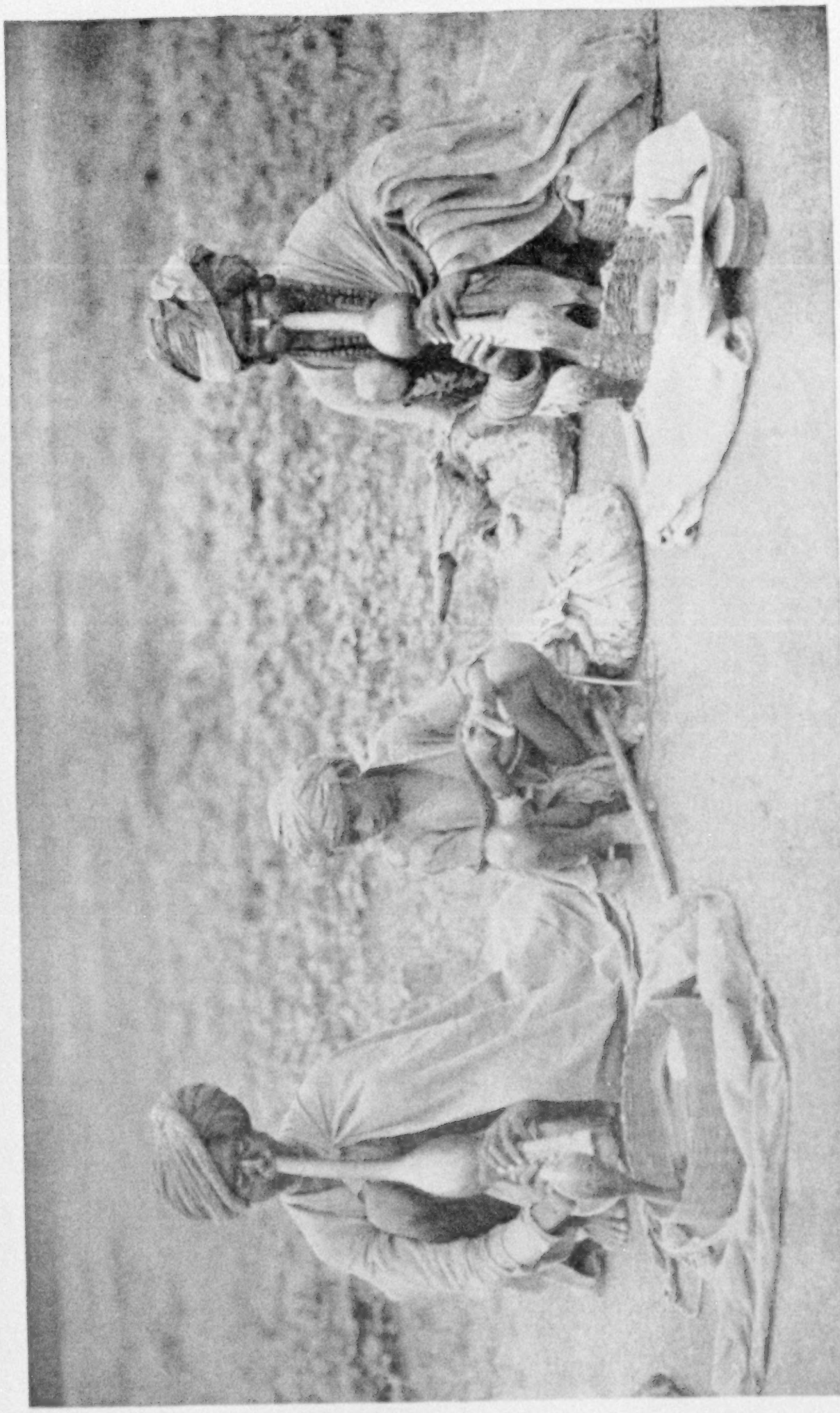
The Indian cobras seldom eject their venom in this way. They are the most spectacular of their group, owing to the vivid markings on the "hood." With some specimens these appear like a grinning death's-head. These are much sought by the Hindu for his snake-"charming" exhibitions.

The greatest requisite of the snake-charmer is nerve, and this must be backed by a thorough knowledge of the serpents' habits. No hypnotism is employed, nor has music the slightest influence upon a snake's actions. The Hindu carries his poisonous reptiles in baskets, and, as he prepares to perform, squats down in front of these and begins a crooning refrain upon a reed. With a bamboo stick the performer removes the covers from the baskets. The cobras rear into view with dilated hoods, and the Hindu sways his body from side to side, with quickening strains upon his flute. The deadly cobras begin swinging to the music and the celebrated snake dance is on.

The actual conditions are these: The shrill notes of the reed appeal only to the imagination of the spectators. The cobra's natural attitude of defense is a graceful, rearing pose, with hood widely spread. From this position the snakes follow the swaying motions of the Hindu's body as they alter their aim in an endeavor to strike. The snake-charmer keeps just far enough away from his serpentine troop to render his bare legs safe from their fangs.

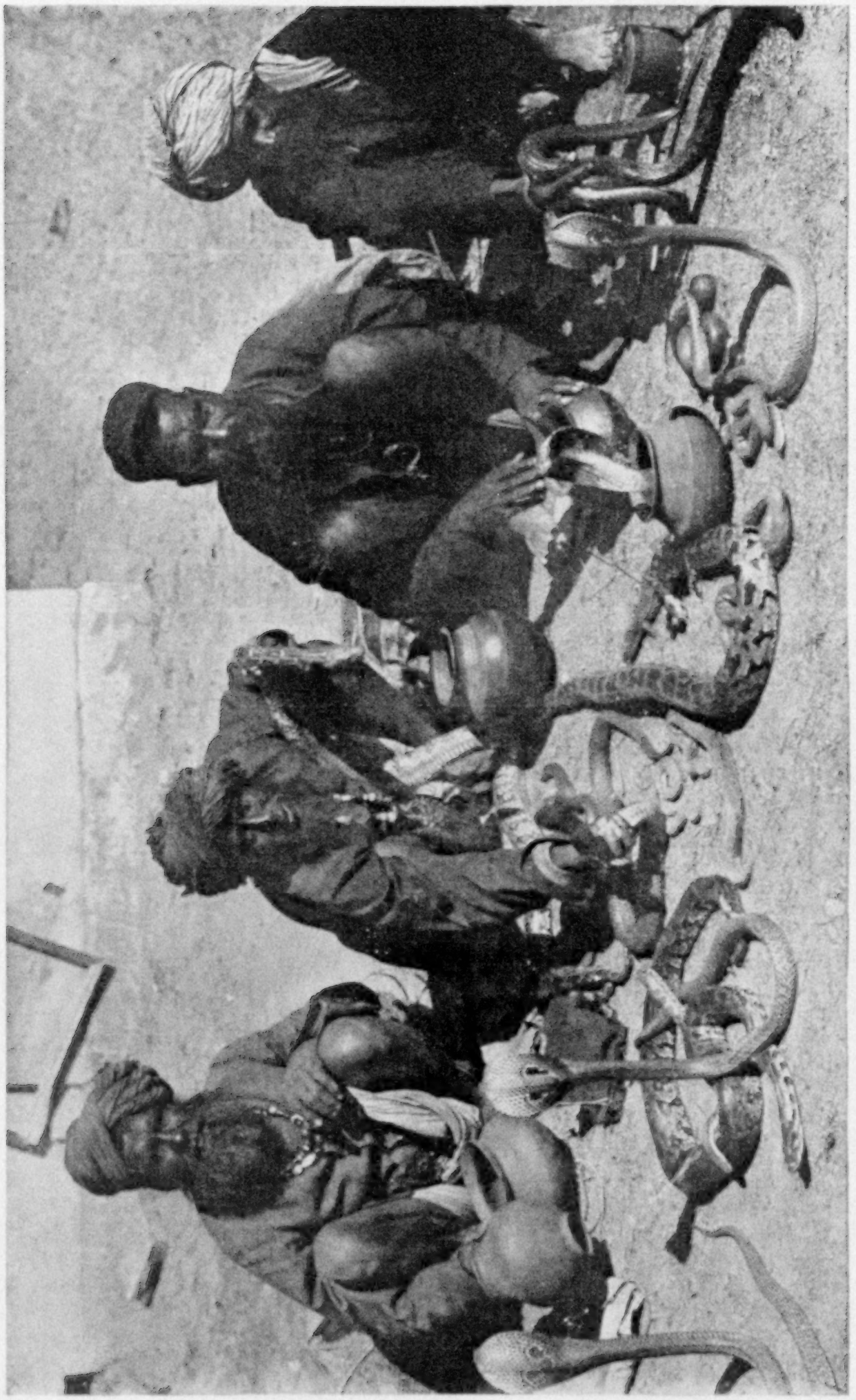
The wily fakir knows very well that if his snakes become accustomed to teasing they will "dance" with less energy. He consequently keeps a fresh supply of undisturbed specimens on hand.

Some of the more daring Hindu snake-charmers immunize themselves against the action of snake venom by taking a course of diluted injections, gradually increased in strength until the desired condition is attained. These men recklessly handle their snakes. The more clumsy fakir, who gives a less finished exhibition, is not taking any chances. He extracts the fangs from his poison-



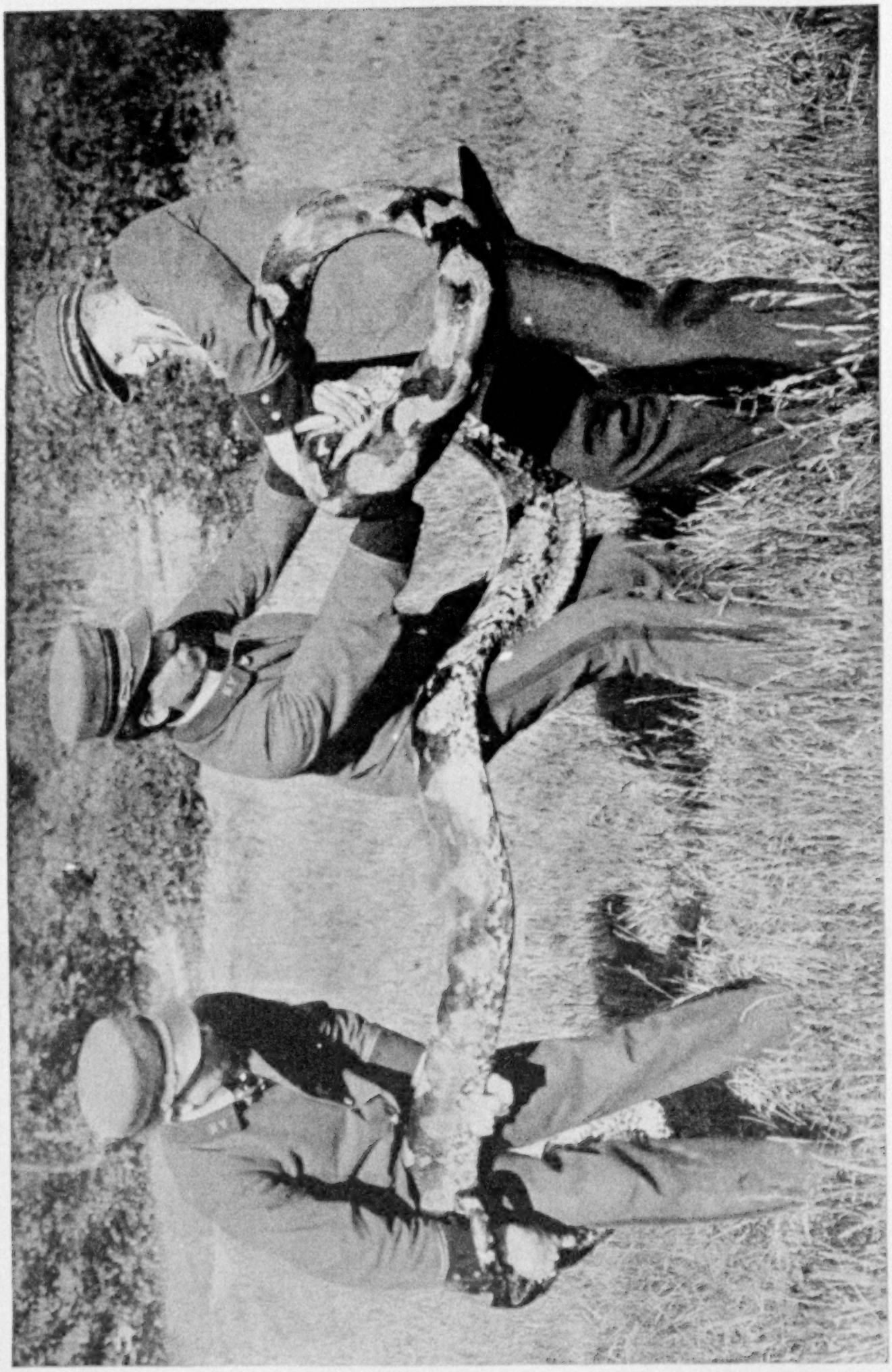
SNAKE-CHARMERS: CEYLON

Photo from Dr. Alexander Graham Bell



SNAKE-CHARMERS IN INDIA (SEE PAGE 627)

Photo from Dr. Alexander Graham Bell



TRYING TO MEASURE A REGAL PYTHON (*Python reticulatus*) (SEE PAGE 619)

The snake is about 20 feet long. Photo and copyright by New York Zoological Society. Photo by Elwin R. Sanborn

ous snakes, so mutilating the animals' mouths in the process that they have no desire to bite. The Hindu of this type ostentatiously handles a few harmless snakes, mostly small pythons.

While the cobras and their allies must be rated among the most deadly serpents known, the venom apparatus is rather crude in its development. The fangs are small, but these diminutive venom-conducting teeth inflict wounds more speedily fatal than the enormously elongated hypodermics of the vipers, unless the fangs of a reptile of the latter kind should wound an important blood-vessel.

Among the allies of the cobras is a number of dangerous snakes that evolution has handled in an incomprehensible manner. The species of *Doliophis*, of Indo-China and Malaysia, are inoffensive in appearance, but remarkable in having enormously developed poison-secreting glands, which, instead of being confined to the head, extend a third the length of the body. This extraordinary development has pushed the heart farther down the body than with any other snake.

THE VIPERS

In strong contrast to the graceful elapine poisonous snakes, the members of the viper family are thick-bodied and forbidding in appearance. Africa is the home of the typical vipers, and a number of these snakes inhabiting that continent are the most hideously ugly reptiles in existence. They exhibit every outline that is formidable and villainous in a snake, and are exceedingly sluggish in gait. Quite incongruous with the structure are their exquisitely beautiful colors and patterns.

The most widely distributed is the deadly puff adder, with its sooty-black chevrons separated by cream-colored crescents. This snake hisses vociferously when disturbed. It lies in brushy places in watch for rodents. A dart of the head seals the fate of the victim, which, pierced by the terrible fangs, seldom utters as much as an agonized squeal. Colonel Roosevelt quotes several observations of this snake during his recent trip.

Near allies are the rhinoceros viper and the gaboon viper. The former is gorgeously colored, after shedding the skin, in a fantastic pattern of rich blue, yellow, carmine, and green. Being semi-aquatic, its skin is soon soiled by muddy waters; and, with the pattern hidden, the bloated body and horned head make up a most forbidding combination.

The gaboon viper ranges over the whole of tropical Africa. The body is exceedingly thick, stub-tailed, with a huge, spade-shaped head. The purplish markings form outlines like a chain of hour-glasses, and the silvery white eyes glare in vivid contrast. Instead of progressing in ordinary fashion, this reptile throws forward lateral loops of the body and moves along in an oblique direction to that in which the head is pointing. A captive specimen displayed the trait of striking backwards.

This same example was a voracious feeder and on one occasion swallowed not only its own portion of rats, but those intended for its cage-mates. It was discovered in the morning so gorged that it was unable to entirely engulf the last rat it had eaten, and the tail of which was protruding from the viper's mouth. The snake appeared quite content to await developments; but, rather than have the reptile's gluttony cause its death, the writer withdrew two of the rats with a pair of forceps and the serpent quietly coiled up to digest the remainder.

No species of true viper inhabits the New World. The viperine snakes of the Western Hemisphere belong to a subfamily of the vipers, which is technically known as the *Crotalinæ*.

These are pit vipers, so called from a mysterious organ between the eye and the nostril. The pit appears to perform some important function, as it is lined with a network of nerves and there is a large nerve-lead connecting it with the brain. It has been alleged to be an organ of a sixth sense, but as man lacks the same, it is difficult to imagine what this should be. The rattlesnakes, copperhead snake, water moccasin, bushmaster, and fer-de-lance are typical pit vipers.

A NEWLY ARRIVED ANACONDA FROM SOUTH AMERICA (SEE PAGE 619)

She is 19 feet long. The snake is not so long as some of the big pythons of the Zoological Gardens, but is the thickest ever exhibited in the New York Zoological Park. She is 36 inches in girth. Photo and copyright by New York Zoological Society. Photo by Elwin R. Sanborn.

THE RATTLESNAKE AND FER-DE-LANCE

The most dangerous snake of the New World is the big bushmaster of tropical America. This pit viper appears to represent the ancestral stock of the rattlesnakes. It grows to be 12 feet long and the tail is armed with a long spine. Other species of the genus to which it belongs, *Lachesis*, are very deadly. Best known among them is the fer-de-lance, common on the mainland of South America, but also abundant in some of the islands of the Lesser Antilles. While this serpent is alleged to posses a diabolical temper, it is not particularly vicious, and captive examples become far more docile than many other poisonous snakes.

The most dangerous North American serpent is the big diamond-back rattlesnake of the southeastern United States. Eight-foot specimens are not rare, and, armed as it is with fangs that with a six- or seven-foot specimen are an inch long, this burly brute must be rated as among the most dangerous snakes of the world. Thirteen distinct species of rattlesnakes inhabit the United States proper. If they are all considered under the general head of "rattlesnakes," we may say that four "kinds" of poisonous serpents inhabit this country, thus: The water moccasin, copperhead snake, rattlesnake, and coral snake. The latter is an elapine species, an ally of the Old World cobras.

As poisonous snakes are not at all partial to cultivated areas, and the human inhabitants of this continent don't go about bare-legged, accidents from snakebite in the United States are exceedingly rare.

THE INDIAN CENSUS OF 1911

By John J. Banninga, Pasumalai, South India

TO COUNT 300,000,000 people inside of five hours is a task worthy of any government; yet it was done, and done well, by the government of India on the evening of March 10, 1911. From Cape Comorin on the south to the rugged hills and valleys of the Himalayas on the north, and from the mountains and deltas of Burma to the slopes of the western Ghats, every man, woman, and child was carefully counted and tabulated by an army of more than two million enumerators. To say that no mistakes were made would be assuming too much, but that the record is as accurate as that of any other country, even though the latter take months for the work, is not saying too much.

That this work could be done by men unprepared for their work and without instruction must not be supposed. In fact, for many months beforehand the government set apart men of experience who planned carefully for all the details involved. They traveled all over the country, made careful investigation into minute caste distinctions and religious differences, heard all manner of petitions from all classes of people, and appointed their army of superintendents, supervisors, and enumerators.

The country was divided into more than two million "blocks," and an enumerator was appointed for each block. Groups of "blocks" were called "circles," and several circles made a "charge." Each "block" contained not less than twenty-five houses nor more than fifty. Some weeks before the actual date of the census every house was numbered, and then the enumerator went around and made the preliminary census by making out a list of the names of all the persons ordinarily residing in the houses of his block. This list was carefully revised by the supervisor of the circle, and his lists were all checked by

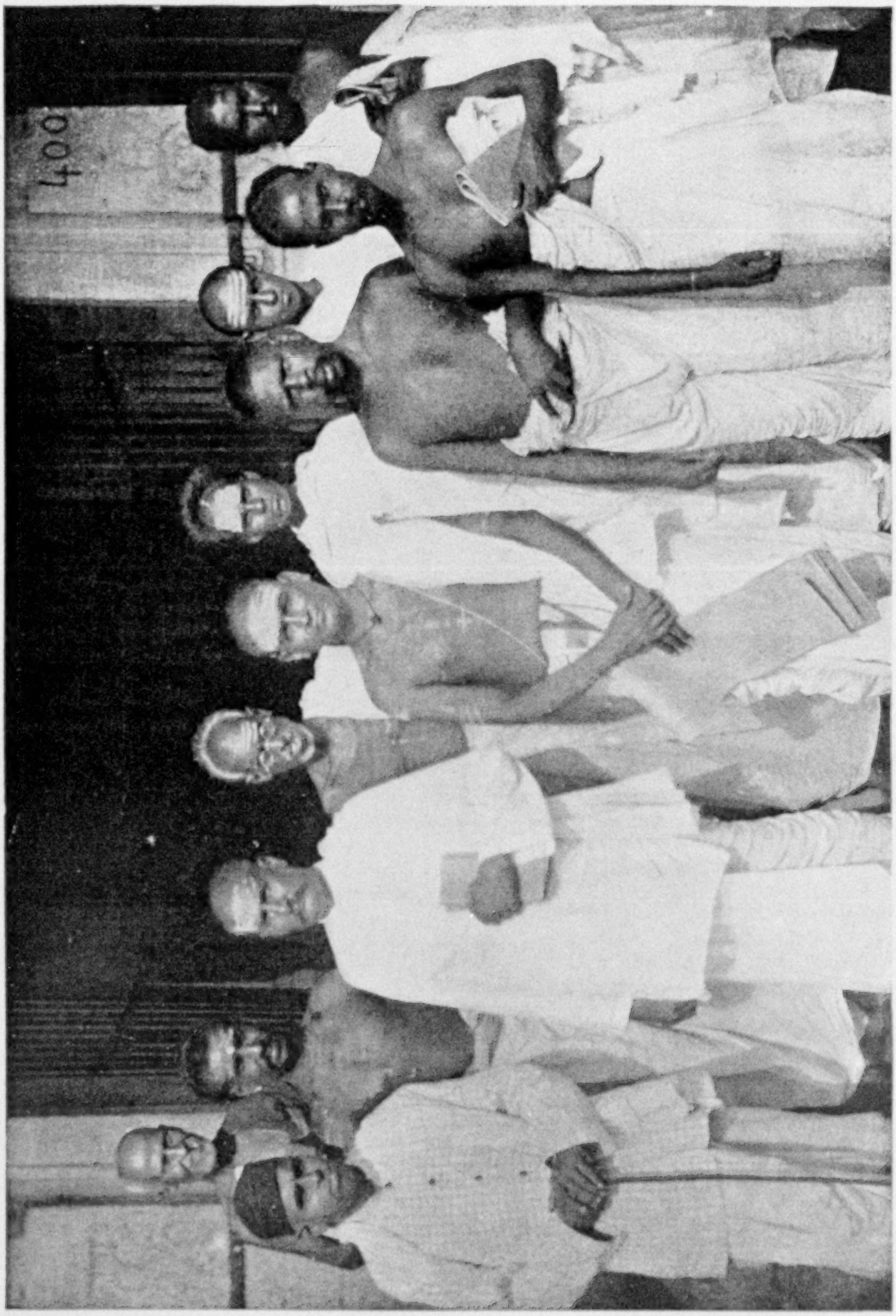
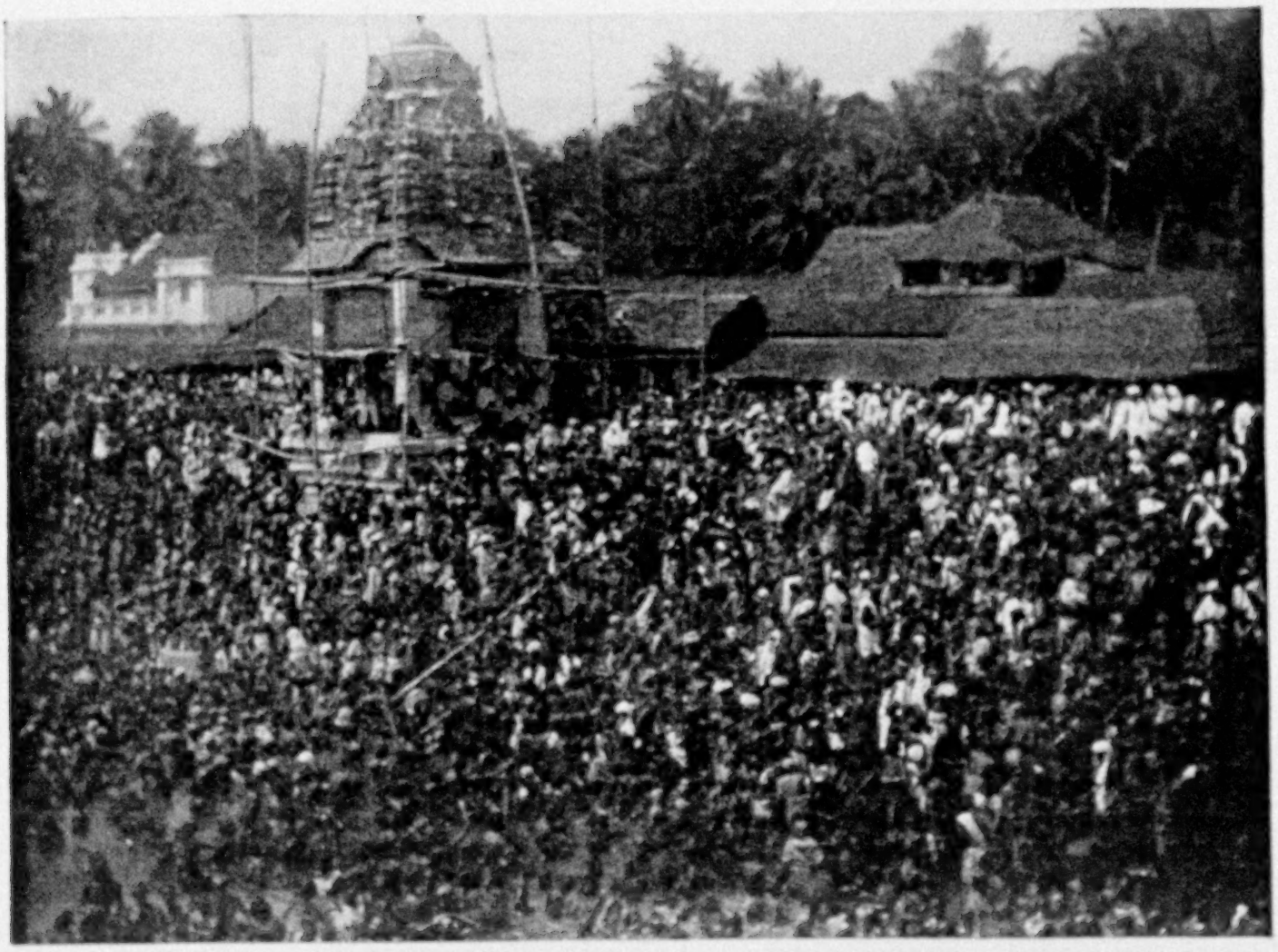


Photo by John J. Banninga

A CENSUS SUPERINTENDENT AND ENUMERATORS MAKING THEIR REPORT THE MORNING AFTER THE CENSUS



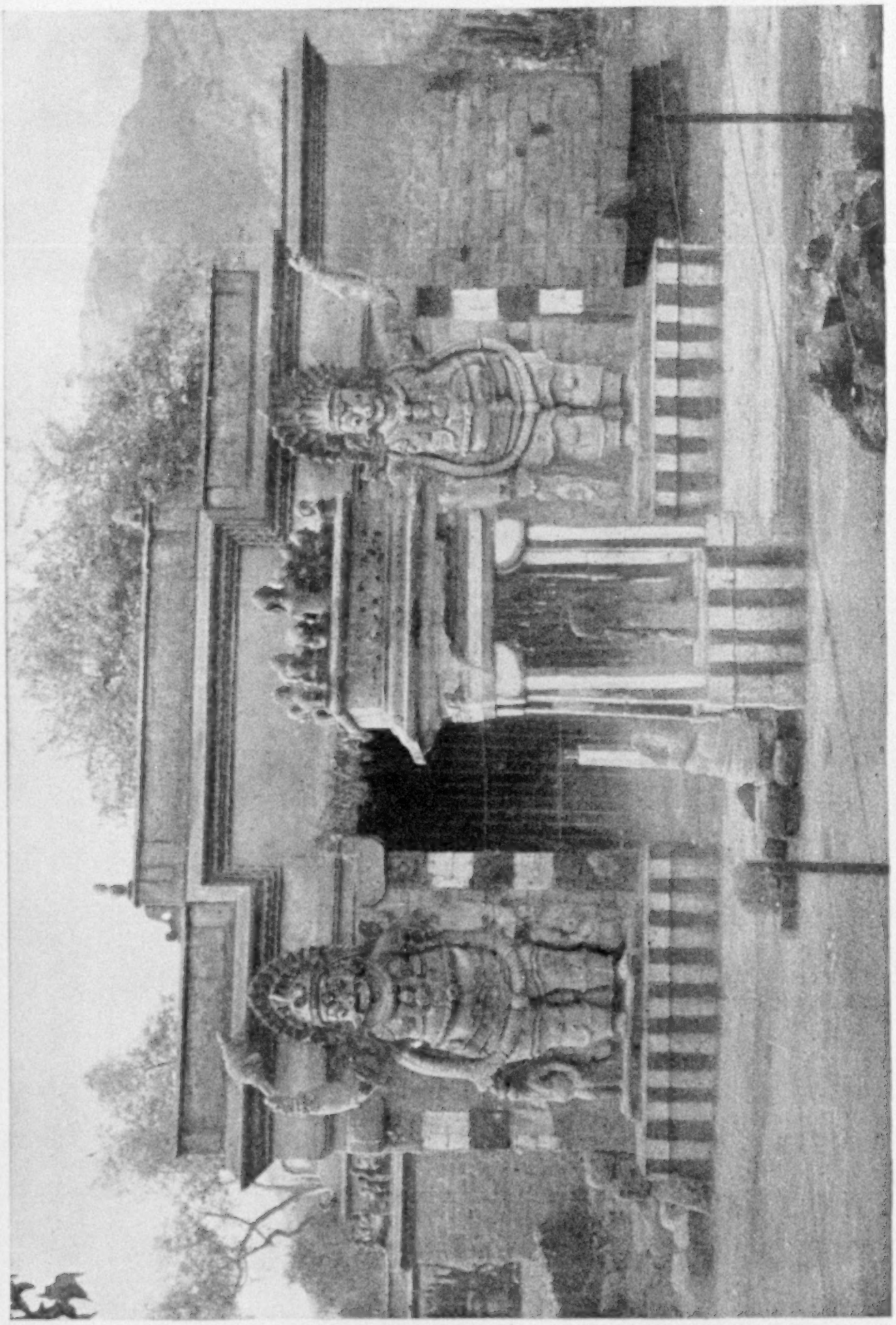
A HINDU FESTIVAL

All people attending these festivals on the night of the census were counted by special enumerators. Photo by John J. Banninga

the charge-superintendent, so as to secure the greatest possible accuracy.

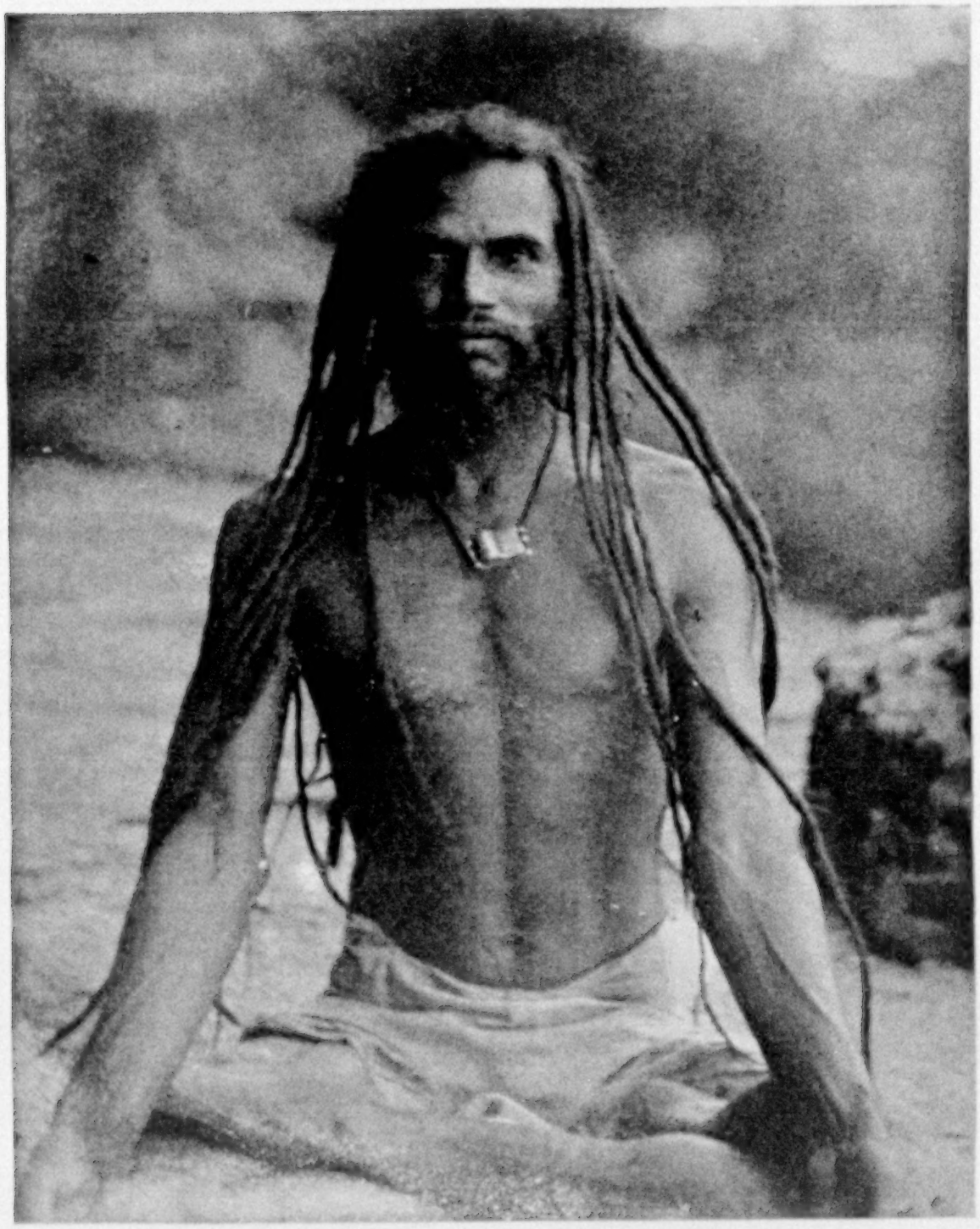
Elaborate provision was made for all who might be traveling by train, boat, or cart on the night of the census. Station-masters, train-guards, and others were enlisted, so that no one might escape. Thousands of Indians travel every night in the bullock carts of the country, the common mode of travel between the thousands of villages that have no railway service. The heat of the day makes the night the pleasantest time for traveling, so provision had to be made for these also; and tollgate keepers, as well as the keepers of caravansaries, were appointed as enumerators to count the noses of all passing through their gates or stopping at their "pettahs," or inns.

At 7.00 p. m. on Friday, March 10, every enumerator started out to make the real count of the people in his block. Going from house to house, he corrected the preliminary record, adding all who had come and striking off all that had gone since the first count was made. Then details as to sex, marriage, profession, age, religion, language, etc., were recorded. In all, sixteen columns had to be filled in regarding each individual. Some of the people seemed to think it a joke if they could manage to have some in their house escape the eye of the enumerator. Children had to be dragged from dark corners and older persons from the cattle sheds, in order that the list might be made complete. If any one escaped entirely he was the hero of the day in his village the next morning.



A ROADSIDE SHRINE IN INDIA

Photo by John J. Banninga



A WANDERING MENDICANT

Over 4,000,000 holy men wander from temple to temple in India, and special provision had to be made to count them. Photo by John J. Banninga

Only preliminary results are in as yet. But there is enough to indicate the growth that has taken place in the cities and in the country at large. Most of the cities show decided gains, some as high as 20 per cent; but, on the other hand, a few show losses. Bombay reports a loss of 4,930 from the number reported in the municipal census of 1906. This is accounted for by the removal of several cotton mills from the city. Calcutta reports a gain of 109,000; Madras now has 517,335 inhabitants. Plague and famine are two of the factors that enter into the explanations for the losses in several cities. As was to be expected, fertile districts have made larger gains than others. Irrigation has helped sev-

eral districts to increase their population. Madras Presidency reports a total gain of 8.3 per cent, as against 7.3 per cent for the previous decade. As in other countries, cities have gained far more than rural communities.

The *Madras Mail* reports the following interesting incident: A detailed census of the inhabitants of the Nicobars was made for the first time this year. All the people of the islands were enumerated except the Shom Pen, a wild, irreclaimable tribe in the center of the islands. It was feared that no census could be taken of them, but by a fortunate coincidence the people themselves supplied the information upon which a fairly accurate estimate could be made. Just before the census party arrived at their island they had sent a message to the people living on the coast, saying that they were intending to attack them. These tribes, being friendly to the English, handed over to them the two tally-sticks on which notches had been cut to show the number of the attacking party. Notches had been cut to show the number of fighting men in each settlement, the settlements being divided off by lateral notches.

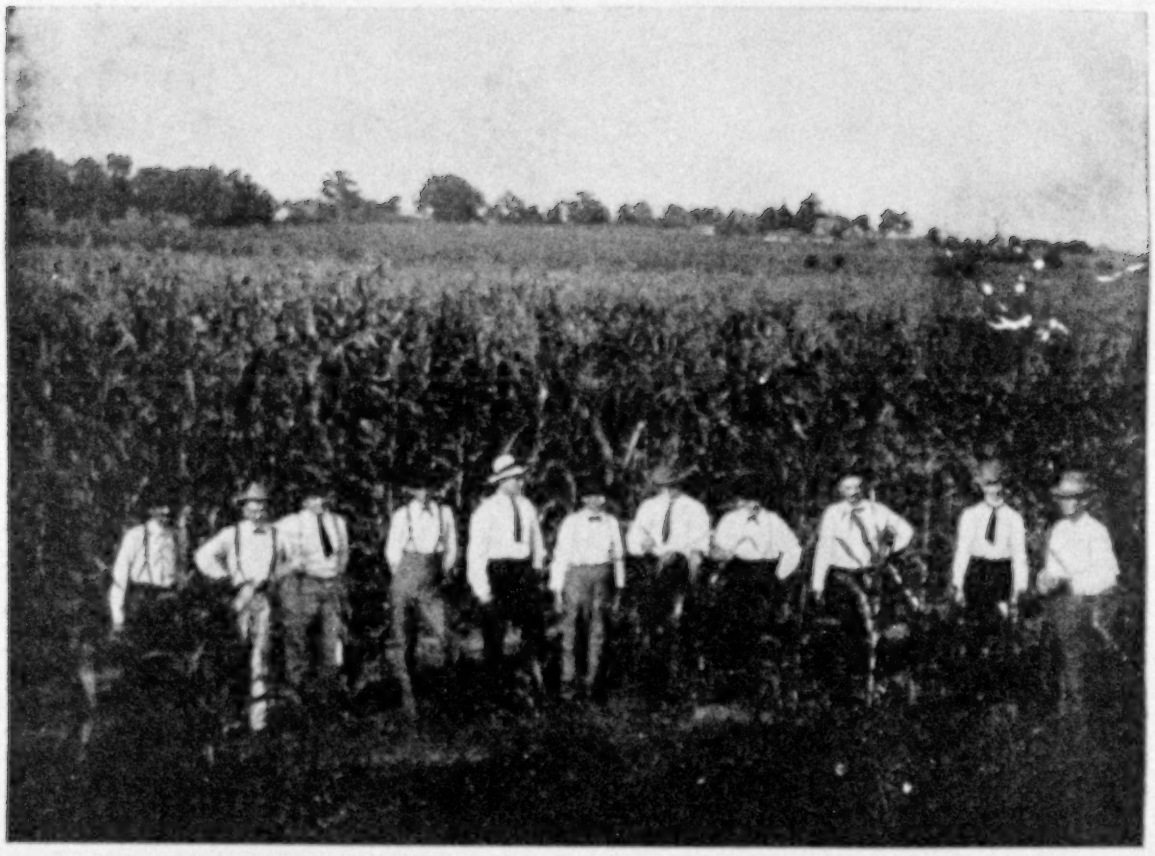
One of the enumerators discovered a marriage party at one of his houses, and instead of the six persons reported in the preliminary survey, there were now over a score. In another village there had been a large fire and a whole section of the town was burned down, but the people were found in improvised sheds not far away, and were counted as if nothing had happened.

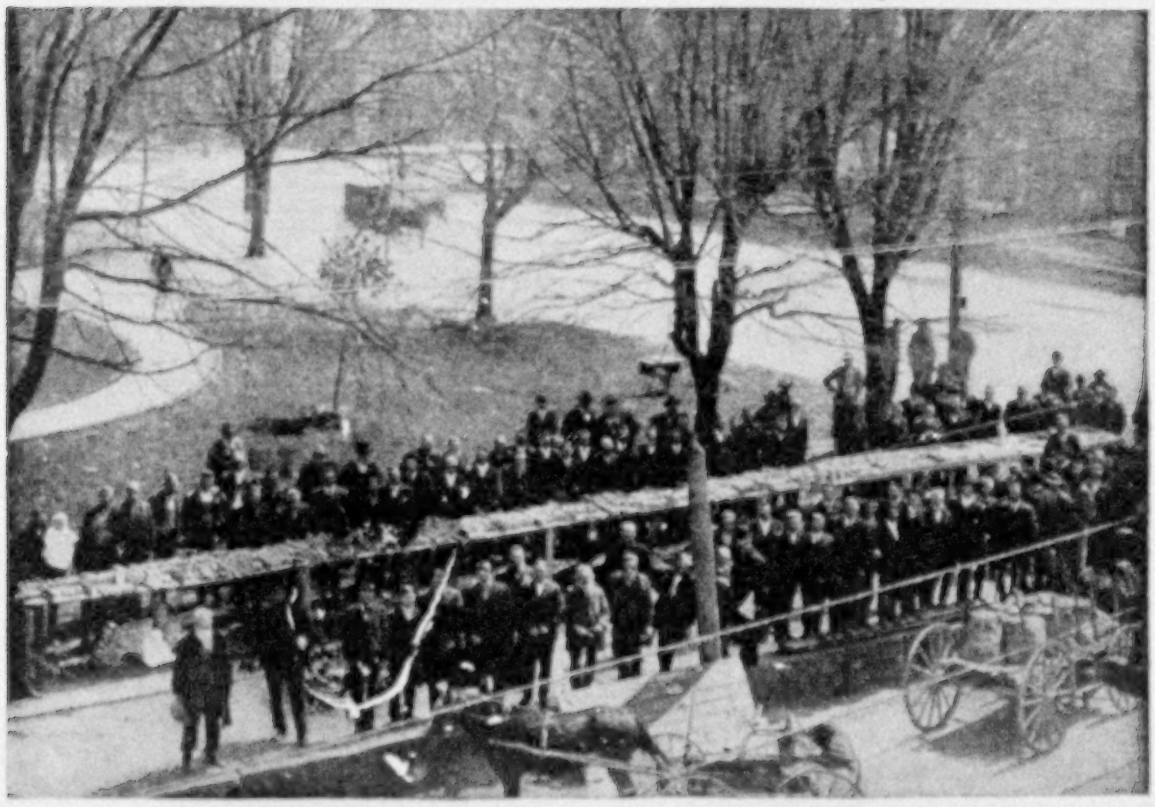
Plague and cholera accounted for many decreases in the number in any given house. A few days before the census three bodies were carried out of one house in Madura as a result of cholera. In the plague-affected areas whole districts in the cities were depopulated and the people required to live in booths and tents outside the city.

In some places the enumerators had great difficulty in getting men to give the names of their wives, or wives those of their husbands. It is considered unlucky to speak the name of one's helpmeet in this land.

The crowding of some of the wards of the cities is illustrated by the following story from Bombay: An enumerator found a building with 150 rooms, in each of which thirty people were living. Another building, a kind of improved tenement, in each room of which four people were supposed to live, was found to have an average of thirteen in a room. The enumerator was asked in this case to act the part of a confidential friend and report only four to a room. The homeless and wanderers, in which each city abounds, were gathered together in suitable places where the necessary details were taken.

The final returns will be awaited with a great deal of interest. All the sections of the community will want to know how they stand with reference to the last census. The Christians then rejoiced in a 28 per cent gain. Have they made as great progress in the last decade? The Hindus lost in the closing decade of the last century. Have they made up that loss or not? The past has been a decade of wonderful progress in politics and commercial affairs, and all will look eagerly to the disclosures of the present census to see what bearing the figures gathered may have on these subjects. It may take a year before the final returns are published, but when they appear they will have significant facts to relate to those who know India and her people.

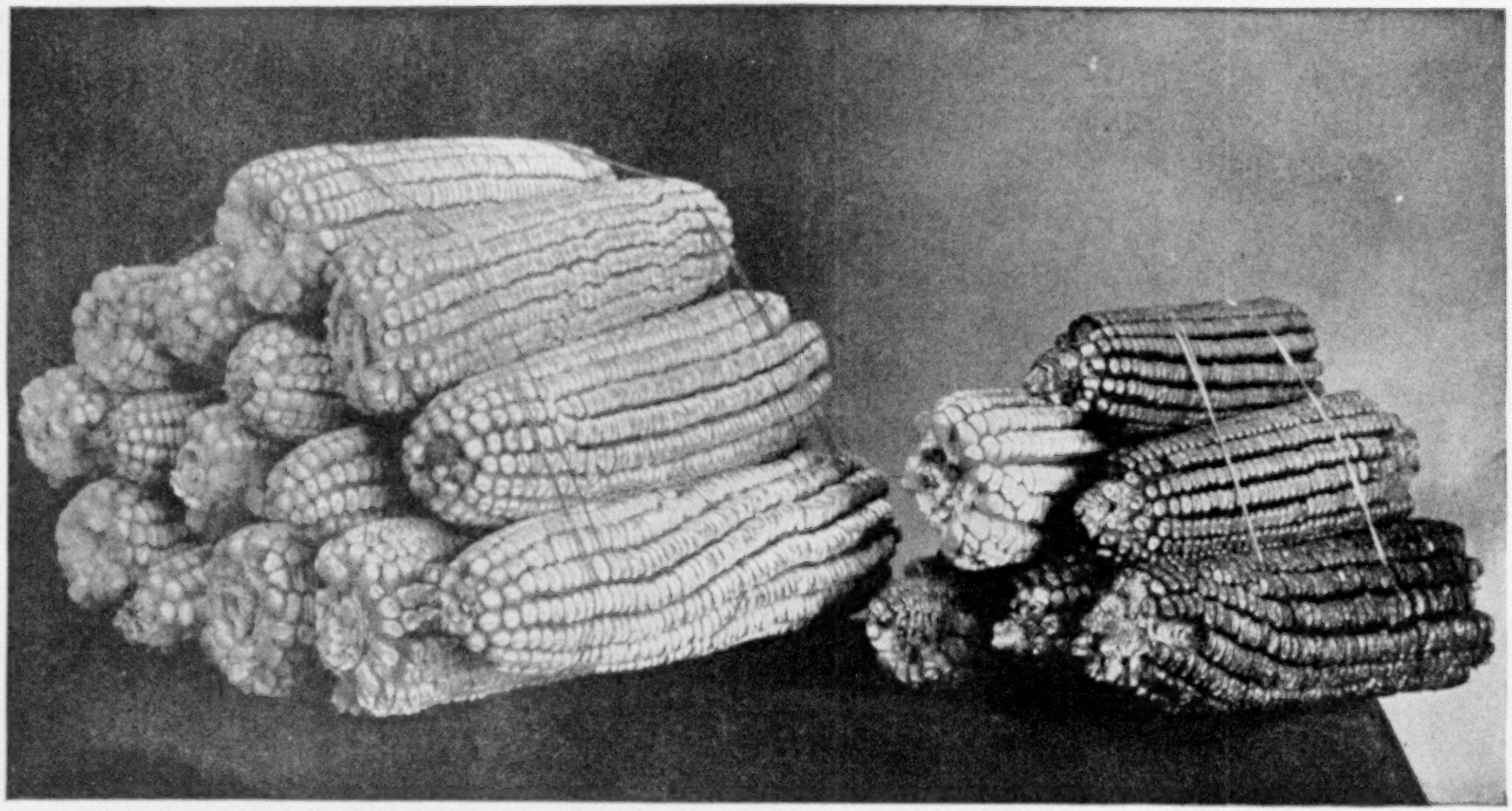




Photos from U. S. Department of Agriculture

CORNFIELD ON A DEMONSTRATION FARM, SHOWING A SCHOOL FOR FARMERS ENGAGED IN SELECTING CORN

CORN DAY AT MONROE, N. C., SHOWING TWO HUNDRED FARMERS SELECTING AND TESTING CORN FOR PLANTING (SEE PAGE 641)



SAMPLES OF CORN SELECTED BY FARMERS FOR SEED

The ears on the right are those selected by farmers in a territory in which no demonstration work has been done. Those on the left were selected by farmers in a territory where demonstration work has been conducted one year. Photo from U. S. Department of Agriculture.

From Yearbook, Department of Agriculture, 1909

HOW TO MAKE A FARMER: THE BOY WHO GREW THE CORN SHOWN IS STANDING IN HIS DEMONSTRATION PATCH

BOYS' AND GIRLS' AGRICULTURAL CLUBS

THERE have been few developments in recent years of greater educational interest and value than the work done by associations of boys and girls in agricultural and domestic-art undertakings. As a rule these have had their beginning in some form of competitive contest for special occasions or awards. Thus we find clubs for corn growing, cotton growing, potato growing, fruit growing, poultry growing, live-stock study, bird study, home culture, and high-school improvement. All of these have been more or less agricultural in their general character.

To any who are unacquainted with the nature of such clubs, it may be explained that a corn-growing club is an association of boys, who enter into a competition to determine which can grow the most or the best corn on a certain area of ground under definite rules of planting, cultivation, and exhibit of their product. A cotton-growing club would undertake a similar competition in producing the best yield of cotton under prescribed conditions. For girls these contests have frequently taken the form of bread making, sewing, or joint contests with boys in gardening or poultry raising.

The members of such clubs have been led to observe more closely; to recognize good and bad qualities in the products they have grown, and in the insects, fungi, and other various conditions affecting their work. They have learned something of the value of labor, the cost of production, and the keeping of simple accounts with different farm and household affairs; they have been encouraged to read good literature, and have learned some of the sources of good agricultural literature.

They have learned the value of organized effort, of co-operation, and of compromise; and the social instinct has been developed in them—a matter of great importance in rural districts, where the isolated condition of the people has long been a great hindrance to progress.

The influence upon the communities at large—the parents as well as the children—has been wholesome. Beginning with an awakening interest in one thing—better seed corn, for example—communities have rapidly extended their interests to other features of rural improvement.

A PRACTICE CLIMB, SEVEN AND A HALF HOURS: THE UNTERGABELHORN, 11,150 FEET (SEE PAGE 647)

This was the second day's climb. The first was the little Riffelhorn, 9,617 feet, over whose top rises the steep Lyskamm. Note the funniculaire to the Gornergrat, and over it Monte Rosa. To its right can be seen our route up the latter, all except the steep rock ridge, and on its long slope the descent by the usual, easier route. Photo by A. G. Wehrli

A WOMAN'S CLIMBS IN THE HIGH ALPS

By Dora Keen

With Illustrations from Photographs by the Author and Others

CLIMBING in the High Alps in a bad season may mean exhausting rock work, at times very much lengthened and complicated by a covering of snow. It may mean very fatiguing or dangerous experiences on snow and ice, or sudden storms, with peril of freezing to death or of losing one's way, or there may be various thrilling combinations of experiences.

The Alps are not, however, to be named with what may be experienced in higher mountains in other lands; for when very hard work has to be done at very high altitudes, or is combined with problems of intense cold, a jungle base, an exhausting approach, or two or more of these conditions combined, the difficulties of mountaineering become enormously complicated. The Alps present no such problems.

They are not to be compared with the brilliant achievements of such spirited and versatile explorers as the Duke of the Abruzzi and others, in the Himalayas, in Alaska, in Africa, in the Andes, and even in the Caucasus. My story of two short seasons in the Alps is therefore presented in all modesty, with no claim to have done any more than others under like conditions, and no space to try to make the reader feel the call of the mountains, to dwell on why it all pays.

The High French Alps, in the region of Chamonix, Haute Savoie, and Dauphiné, and the Swiss peaks about Grindelwald and Zermatt, present about as difficult actual mountaineering work, I believe, as has yet been attempted anywhere. Especially is this true when bad weather makes the condition of the mountains such as it has been for the last two summers. This is the way that I know them; for what serious mountain climbing I have done has been done during a month at Zermatt, in 1909, and a little less time at Chamonix, in 1910.

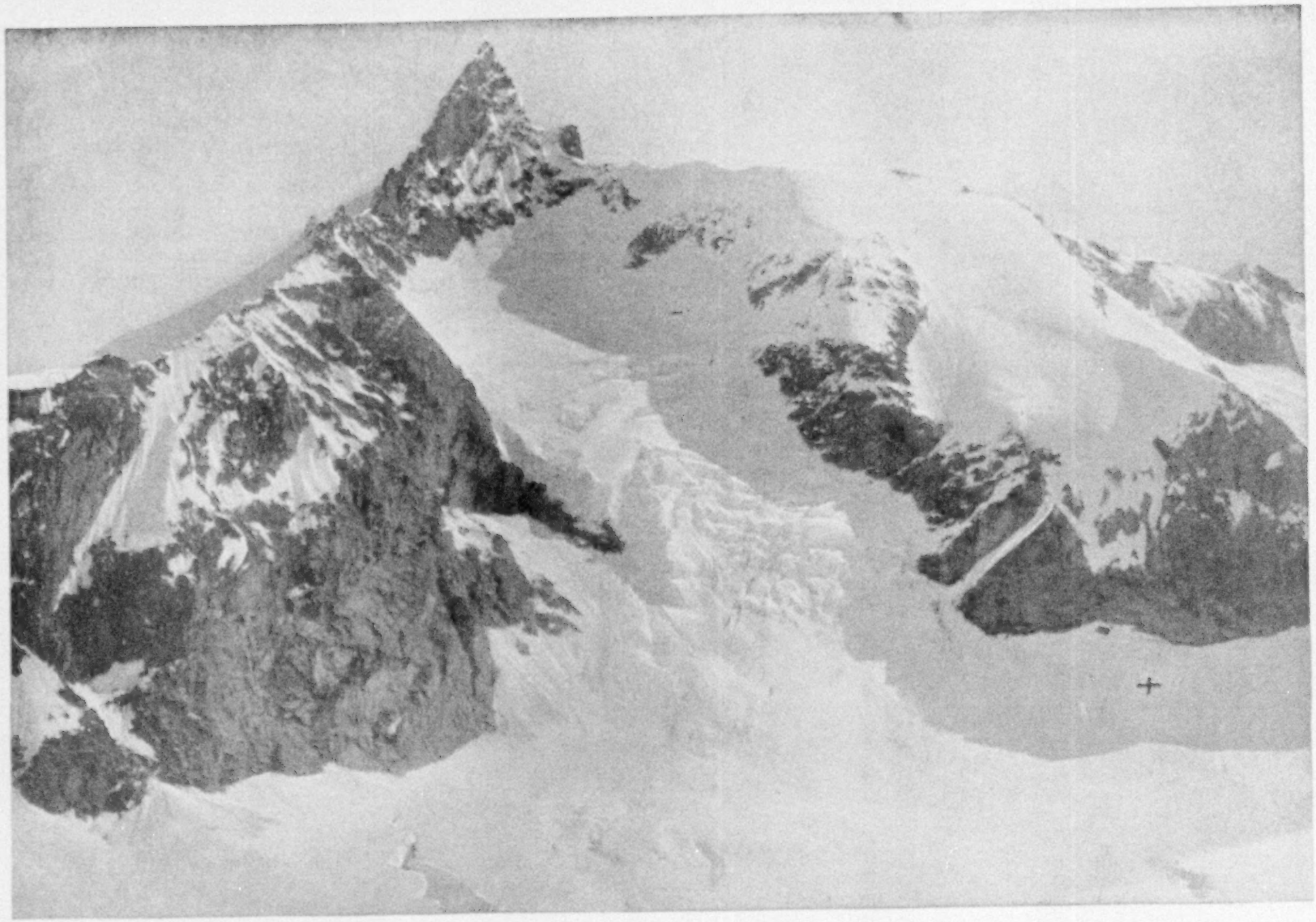
WHY I CLIMB

To those whose love of sport and adventure need not yield before considerations of time and cost, the little explored peaks of distant Asia and other lands, and even the Canadian Rockies, of course have greater charm, since in those regions are lofty and difficult mountains that have not yet been climbed. To me, however, mountain climbing is a sport that is worth while in itself—to those who enjoy it—apart from any question of fame or of new achievement. My objects have been neither.

I climb for pleasure, for the wonderful views and the vigorous exertion, for the relaxation of a complete change for mind and body, and because of the inspiration to the spirit. To combine exploration with mountaineering must, no doubt, so increase the interest as to well repay the augmented difficulties. All I would emphasize is that to climb anywhere repays the effort, even if it must be within reach of civilization and where others have gone before. To me there is ample reward in the uplift of the spirit; in the moral discipline, the keen interest, and the training to think, of a hard battle carefully planned; in the satisfaction of a love of adventure, and in the invigorating physical exercise.

CLIMBING FACILITATED IN THE ALPS

The Alps are accessible, far more accessible as yet, even to Americans, than are the finer peaks of America. Railways, villages, and huts make approach to their very bases easy. No extensive and expensive camping outfit is required. Food and clothing do not have to be carried great distances by porters or mules, and shelter from cold at night or from



THE ZINAL ROTHORN, 13,855 FEET, CLIMBED BY ITS RIGHT SNOW RIDGE AND LEFT SUMMIT SLOPE (SEE PAGE 647)
It was my first peak of first class, a 13-hour day. The cross shows where a caravane had fallen from the slippery ridge. Photo by G. P. Abrahams

sudden storm may be found in huts at the base of all the principal peaks.

The large membership of the Alpine clubs—sometimes 20,000—furnishes them with the means to erect and maintain huts or cabins at such points as they may be needed, but where private enterprise would not find sufficient inducement. The highly specialized business of guiding mountain climbers is also under their direction. They license the guides and porters and fix the rules and tariffs for their direction; for, unlike the English and American Alpine clubs, the Alpine clubs of Continental Europe are not, for the most part, limited to those who have made mountaineering records of a certain standard. They are made up chiefly of members who desire to encourage the sport for its own sake and also as a method of attracting tourists.

In the course of travel, a love of exercise and adventure had given me a few easy experiences in the mountains. They began as a child in the Adirondacks and the White Mountains, were continued in the Selkirks of Canada, in Norway, and the Dolomites, and finally in the Andes. To climb the Matterhorn gradually became a dream, and quite unexpectedly, in August, 1909, I found myself within reach of it at the right season and with time to get in training. So to Zermatt, German Switzerland, I went.

At the head of a smiling valley, itself 5,315 feet above sea level, towers the mighty Matterhorn, its isolated grandeur dominating the scene from every point. By means of a funiculaire, even those who do not climb may here behold the "panorama grandiose" of these finest peaks of the Alps, and as they gaze, from its center the commanding ridge of the Gornergrat, rising as it does 4,975 feet above Zermatt, in the very heart of the High Alps, even the least imaginative traveler feels the inspiration of the scene. It is a complete amphitheater of snow, ice, and rock peaks. But to him who has mounted thus easily it is not given to know the joy of the mountaineer, the feeling of triumph and exhilaration in such a spectacle. To him it means most, since to him it has cost something—in the way of effort, and difficulty, and anxiety—to attain the summit from which he fain would gaze.

To climb requires a good heart and endurance. The rest comes with experience. The technical problems have all been solved by the earlier adventurers. A gradual training of the muscles is best, in order that they may not get too tired, and for the feet, in order that they may not blister. Two hours on a steep path the first day, five the next, nine the next, and after that almost anything—that is all the training it requires to make ascents lasting anywhere from 12 to 19½ hours, as most of the serious ones do, without any bad effects.

One goes up a path to the base hut or cabin two to five hours above the valley, the afternoon before, is asleep by 8 p. m., gets up at 1 the next morning, and starts at 2 a. m. The early start is in order to have plenty of time to get off the mountain before night, and also to have the snow in good condition. That night one has a long sleep comfortably in the valley, and the next day wakes up fresh and ready for the afternoon's walk to the base of another peak. Bad weather interrupts the program often enough to afford variety and respite, or, rather, the climbing affords a relief from the frequent bad weather of the high mountains.

ZERMATT

Of the ten ascents that the weather permitted of my making at Zermatt, only four could be of "first-class" peaks, for the high and difficult rock climbs are dangerous when covered with excessive amounts of soft snow, and even when I arrived an unusual quantity of the winter's snow still remained on the mountains. The four first-class ascents were the Zinal Rothorn, Monte Rosa, the Weisshorn, and the Matterhorn, and with these only does space permit me to deal.

My first four climbs were in preparation for the Matterhorn, but on the day

LOOKING AT OUR ROUTE UP THE RIMPFISCHHORN, 13,790 FEET (SEE PAGES 651-660)

Its ascent resembled that of the Wellenkuffe. Going on after this 11-hour ascent to the base of Monte Rosa, by the route indicated in the lower line, made a 16½-hour day, and the next day we climbed Monte Rosa. The arrow shows where to go for water. From the Weisshorn hut, 9,380 feet. Photo by A. G. Wehrli.

that I was ready to start for its base there came a bad storm, which made this ascent quite out of the question for a time, and so it continued for three weeks. Not in years had it been so white, so perpetually white, for bad weather continued to come about every third day. When for a day or two the sun shone again, other ascents would become possible—the lower and less steep rock ascents, the snow mountains, even the Weisshorn, but not the steep and lofty Matterhorn.

THE RIFFELHORN, 9,617 FEET, 5 HOURS*

The little Riffelhorn (see picture, page 658) was chosen to begin on, just for a little rock practice, and for my guide to judge what training I needed. Even from its harder side it meant only 40 minutes of real effort, roped to one guide.

THE UNTERGABELHORN, 11,150 FEET, 7½ HOURS

The next day came the Untergabelhorn (see picture, page 642). This likewise was climbed by its harder side, from the Trift Hotel, and one bit was difficult; but even so it required only one guide. A hailstorm overtook us as we approached the jagged rock ridge, making it cold and slippery work. Three guideless gentlemen below, although ascending by the easier route, turned back. Because of the route and the storm, we were four hours from the hotel to the top.

After the first grassy slopes and gravel—for all ascents begin way above timber line—came a "couloir", or gulch, in the rocks filled with snow and débris. Mounting directly up it, we gained the rock ridge which we were to follow to the top. Going by this route, at one point on the ridge was a rock slab that slanted down rather steeply and connected with the next high point only by a crotch at one of its lower corners. I had to lie on my back and slide down it six inches at a time for 15 feet, fearful of sliding off into space, yet secured by the guide from above as he carefully let out the slack in the rope. He followed, with no one to hold him, stepped over my head, while I sat astride the crotch hugging the rock overhead, and climbed up it 20 feet perpendicularly above me, I following.

THE WELLENKUPPE, 12,830 FEET, 8 HOURS

The Wellenkuppe (see picture, page 659), four days later, proved more interesting, colder—for it was higher and a snow summit—but not much longer, because less rock work. Only below its summit were there any rocks, but there was much snow on them and my feet became numb. The snow-covered Trift Glacier had to be traversed, both going and coming. Two guides were therefore necessary, for safety dictates that there should never be less than three persons to cross a glacier. If one should fall in a "crevasse," or crevice, the weight of the other two would more than balance the drag on the rope and enable them to pull him out.

THE ZINAL ROTHORN, 13,855 FEET, 13 HOURS

At the worst point on this easy Trift Glacier (see picture, page 644), jutting rocks at one side led the eye up to a steep slope of snow along whose crest lay the route to the difficult Zinal Rothorn.

"It was here that Mr. —— and his guide were killed," said my guides, pointing out to me the spot on the ridge where he had slipped and had dragged his guide down the slippery snow and over the cliffs, to be dashed to pieces on this glacier far below. This was my next climb, two days later, so I took care to have guides who knew their business and could be trusted to hold me if I slipped.

The ascent of the Zinal Rothorn took half as long again as the Wellenkuppe, 6½ hours from the Trift Hotel to the top, for instead of a level glacier to cross,

* The number of hours given for each ascent indicates the time from the base, where the start is made on the morning of the ascent, to the summit and down again all the way to the place where that night is spent.

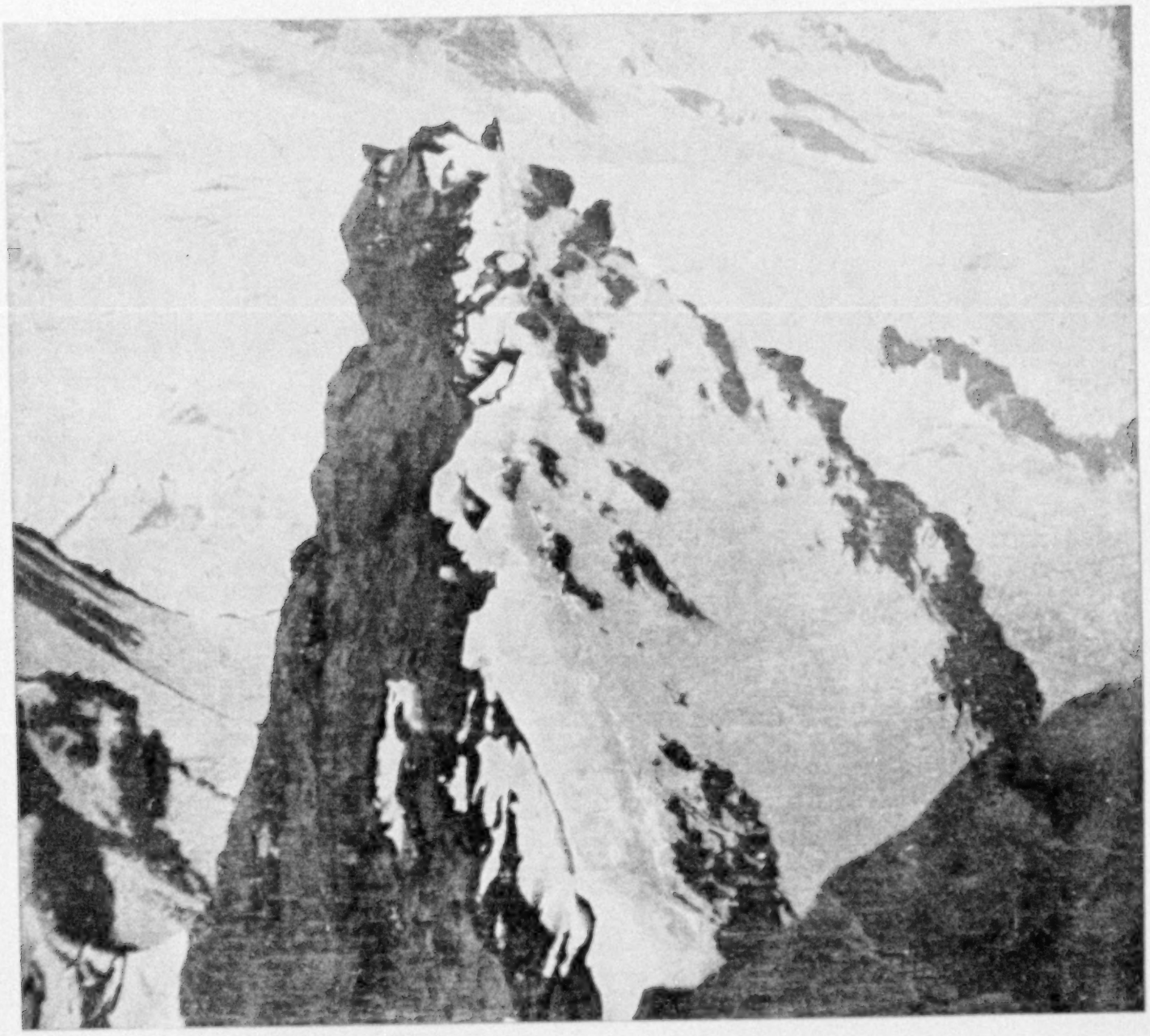
BETWEEN THE RIMPFISCHHORN AND MONTE ROSA WAS A VAST EXPANSE OF ICE AND SNOW

It was like a beautiful billowy sea, with clouds covering Italy beyond. Photo by Dora Keen

there is first a tiresome moraine, then a steep snow slope, then snow-covered rocks, on which the early morning cold was so great that we could hardly stop long enough to eat, and finally the real work of the long snow ridge and the snow-covered rocky summit. To me the snow ridges are the worst part of mountain climbing. So long as I have rocks to hold to I do not mind how perpendicularly I look down; but it is an unsteady feeling to walk along a ridge-pole of snow where one's foot may easily slip, and where the only aid to balance is an ice-pick that may also slip as one leans on it.

The rocks at the top of the Zinal Rothorn also require care. Twice my leader said, "Here is where Mr. So and So was killed"; and again, "Here Mr. So and So and his guide slipped and were killed," to which my reply was always, "Then hold the ropes well for me," and always I had the comforting thought that with care and roped between two good guides one light tourist could hardly cause the entire "caravane" to fall.

At one point were steep slabs with no handholds. Over them one must pass with scarcely any footholds, and these almost too far apart for my reach. Around a corner, too, they went. At such points only one moves at a time, and the others hold on tightly until he has reached a place where he in turn can brace himself while the next person moves. This is one reason why it takes so long to make a difficult ascent. At



OUR ROUTE DOWN FROM THE TOP OF THE RIMPFISCHHORN

It can be traced on the snow to the guide, who is holding the rope for the descent of a caravan ahead. On the rocks over his head is the base cabin of Monte Rosa, reached 11¼ hours later, for the 13½-hour ascent the next day. Photo by Dora Keen.

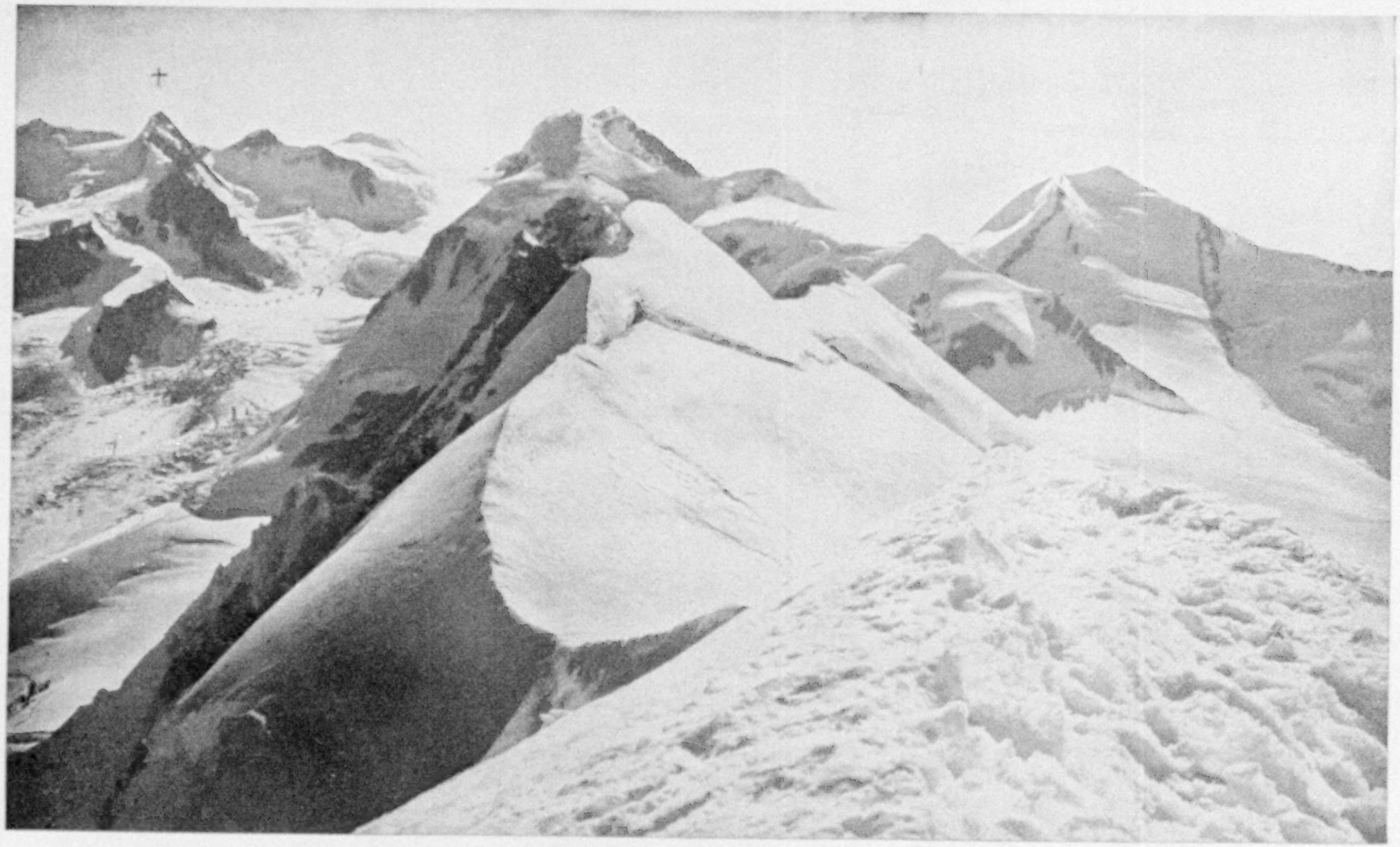
another point we had to climb around a bulging rock that projected over a precipice of at least 2,000 feet.

BAD WEATHER INTERFERES

The Rothorn was my initial first-class peak. I was to start for the Matterhorn the very day after, a week after reaching the mountains, but I was too late. Hard rain below—which means deep, fresh snow above—suspended all climbing for three days, and for the next three weeks there were never enough consecutive days of sun to melt the snow on this high peak.

With so much snow on it, none of the guides would attempt the Matterhorn, for, aside from the danger of slipping on such steep slopes, the labor of cutting the many steps over the snow to such a height is enormous, and the time required to cut them would so prolong the ascent that the caravane might not get down by daylight, and might be frozen to death on the mountain.

As I was preparing for the long strain



OUR ROUTE UP MONTE ROSA, AS SEEN FROM THE TOP OF THE BREITHORN, 13,685 FEET

The five-hour walk up the long Grenzgletscher, by darkness and dawn, was the most beautiful I have ever had. A cross indicates the summit (see page 651). Photo by A. G. Wehrli

on the arms that is the main difficulty on the Matterhorn, rock climbing was my object; but when fresh snow ruled out the higher and harder rock climbs, the snow climbs could be made and were at their greatest beauty. Always possible in good weather, they became only more fatiguing after a storm, when one must toil up through snow that was deep and soft instead of hard and smooth. I emphasize what bad weather conditions mean, because it is often the conditions that make a mountain easy or hard, safe or dangerous, and also because it was the exceedingly bad conditions that made the ascents of the harder peak at Chamonix the next year so very much worse than these at Zermatt.

As soon as it cleared I set out for the two successive ascents of the Rimpfischhorn and Monte Rosa, passing directly from one hut to the other.

THE RIMPFISCHHORN, 13,790 FEET, 16½ HOURS

The Rimpfischhorn (see pictures, pages 646 and 649) was similar in character to the Wellenkuppe. It was a little longer, a little harder, and, owing to its position, the near views from it were much finer, for it directly overlooks the billowy masses of snow and ice that lie between it and Monte Rosa (see picture, page 648). The first bit was troublesome, since, unlike the beginning of most ascents, we had to make our way for three-quarters of an hour up and down among huge boulders, where it was hard not to fall, with three people lighted only by a one-candle lantern. Coming after the Rothorn, its snow fields and snow-covered rocks of moderate steepness and difficulty did not seem hard. Starting at 2.30 a. m., by about 1 p. m. we were back at the little base hotel, and at 2 o'clock off again over the Findelen Glacier and across the Gornergrat for the cabin at the base of Monte Rosa. Five hours and a half it took us to reach it, and brought us in rather tired, for my guides had never done this before, and to gain the Gornergrat had meant finding a way without a path, for two long hours jumping and climbing up and down amid a succession of great rock falls.

MONTE ROSA, 15,217 FEET, 13½ HOURS

After this 16½-hour day, an hour of sleep on a mattress on the floor in the servants' room—and the kitchen floor for my guides—was all we could get, since it was 7.30 p. m. and the cabin was already full, 45 people seeking food and lodging in space intended for 15. It was therefore with a little misgiving, because of weariness, that I started again at 2.30 a. m. for a very high summit, to which we intended to climb by its much harder and steeper rock side.

The usual route up Monte Rosa takes five hours up its long snow slope as far as "the saddle," and thence 1½ hours up the rock ridge, or west "arête." "*Très déchirée*," very jagged, Baedeker well calls this ridge, but its slope is gradual. The ascent by this route is much easier and less steep than by the harder southwest side, which we had chosen; but it is exposed to the north wind, and because of the height and the long time on the snow, there is danger of freezing a hand or a foot. Snow climbs are far more beautiful than rock climbs, but they are less difficult and less varied, and therefore considered less interesting. For the sake of protection from the north wind, and because it would be more interesting, we had therefore determined to go by way of the long Grenzgletscher, the glacier that rises on the boundary crest of Monte Rosa, and then directly up a rock ridge as hard and steep as the Matterhorn (see picture, page 650).

Hour upon hour we mounted this most beautiful glacier that I have ever seen. Its huge, bottomless crevasses, its pure white mantle of snow on which, by their lanterns, could be followed three caravanes ahead and three behind, bound for other points, filled me with wonder. At our right rose the terrifyingly steep slope of the Lyskamm (see picture, page 652); up ahead of us an immense expanse of snow and ice broken only where crev-

THE SNOWY LYSKAMM, MOST BEAUTIFUL OF ALPINE HEIGHTS, WAS SUPERB BY THE DAWN'S EARLY LIGHT

Beyond is the Breithorn, over whose top appears Mont Blanc, far away above the clouds. At the right, the Matterhorn. From near the top of Monte Rosa. Photo by Dora Keen

asses had ruptured. At our left were the snowy rocks of our peak above, far across the great Matterhorn, the Dent Blanche, and even the tip of Mont Blanc, far away. These, indeed, were sights to give joy to the eye and wings to the imagination, and on it all gradually, as we rose, came the changing lights and colors of the long dawn and the first rays of the sun.

At the base of the ridge, at 7.30, we breakfasted. For two hours it had been bitterly cold, and although we climbed up to a point where the sun's warmth might strike us before even this brief stop, and I kicked my feet against the rocks at every step, still for the whole of the next hour they were so persistently numb that one of the guides had to work over them.

So long and exhausting did this ridge seem that I remember, after an hour and a half of it, looking up in silent despair. I saw that it would take me at least an hour more to reach that far glistening summit, towering as it did almost directly overhead. I wondered whether I should reach it, or whether fatigue, cold, or altitude would compel me to give it up. But once on top of Monte Rosa, I forgot the cold and effort and felt it to be the most beautiful climb I have ever had; for, almost the only time in my experience, on this high summit there was little wind and sufficient time and warmth for an hour of enjoyment and rest.

Photo by G. P. Abrahams

A SLIPPERY BUT NOT DIFFICULT CROSSING

THE DANGEROUS ITALIAN SIDE OF MONTE ROSA, BY WHICH THE LOST CARAVAN HAD ASCENDED

They were bound for the Nordend, at the right. The highest point is next, the Dufourspitze, from which I watched the search-party climb to the Nordend and look over. Photo by A. G. Wehrli.

THREE CARAVANS ON THE BREITHORN PLATEAU

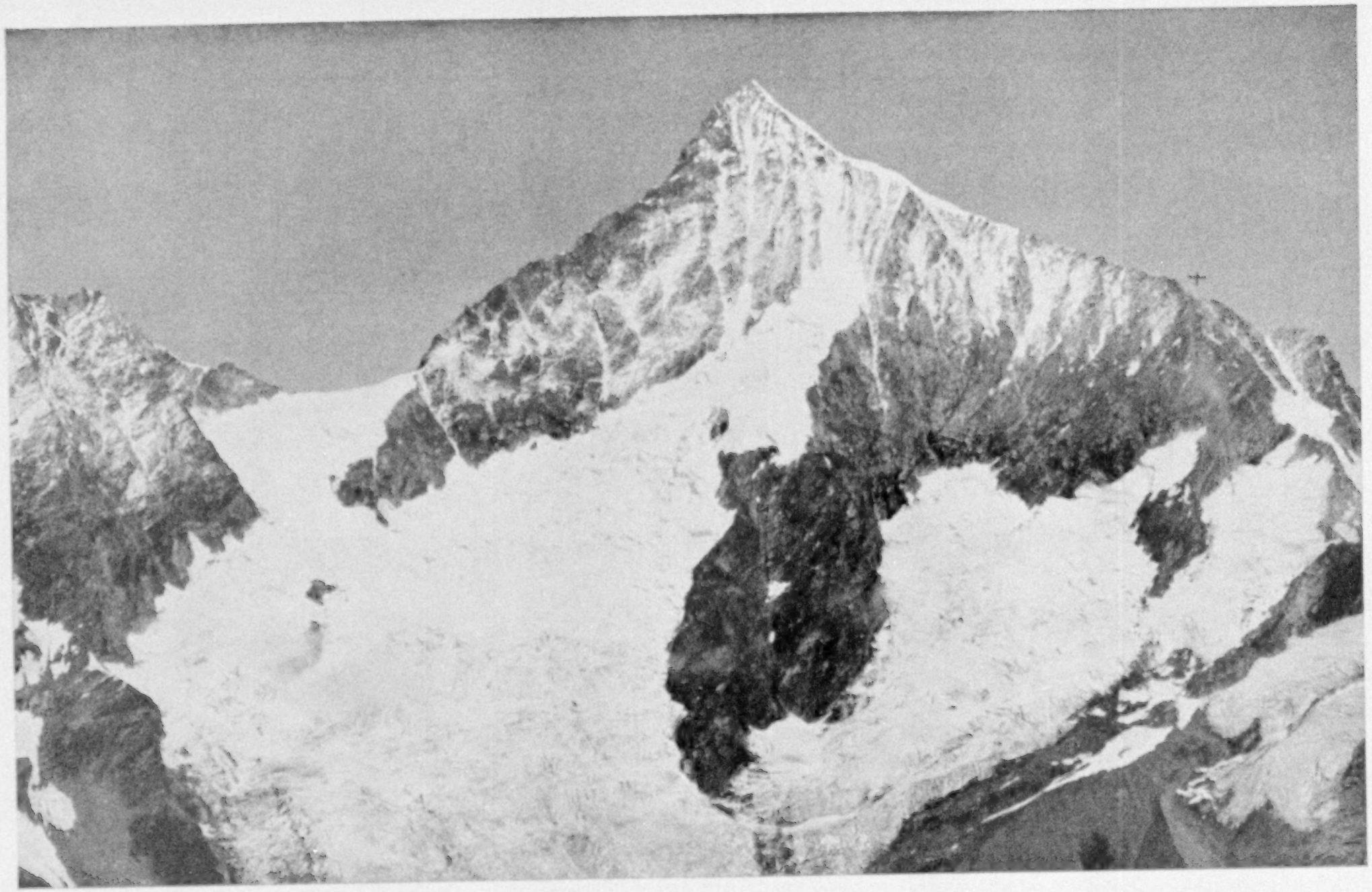
Those nearest are seated on ice-axes breakfasting. The ascent is all snow, and easy, but it was so cold that three out of twenty caravans turned back because of freezing feet. Photo by Dora Keen.

Down by the usual route took us only two hours and a half. That is the difference between a snow mountain, where one can occasionally run or slide, and a rock summit, down which one must climb with care, which takes time. To reach the saddle was an hour's descent, and extremely distressing to me, for the rock ridge from the summit to that point, although not to be compared for steepness to the one by which we had ascended, was very narrow. It consisted in a series of rock points between which one must descend steeply on the crest of deep snowdrifts, which sloped sharply away on one side, while on the other was a precipice.

Below the saddle, however, we fairly ran down the snow slopes in the broad track of the seven or eight other caravanes that had already gone up and down again by this easier route. Running and sliding in the deep snow that a noonday sun had by this time thawed, leaping over the crevasses on the way, in an hour and a half from the saddle we were down at the cabin. I was panting and perspiring, but not tired now, and my guides were exultant when they found that the only other tourist that had gone by our route, although he had done nothing the day before, lay asleep, exhausted.

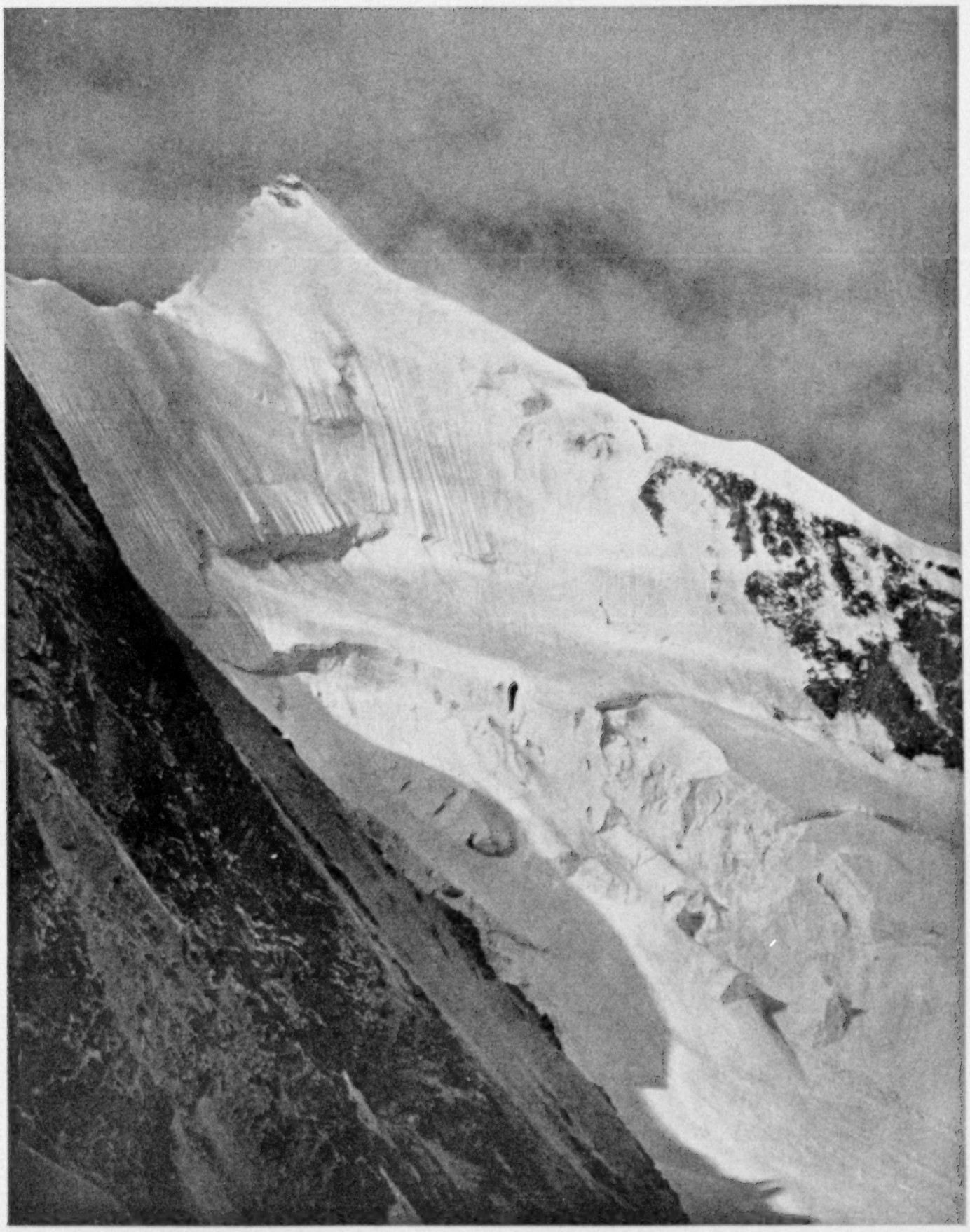
THE BREITHORN, 13,685 FEET, AND THE LITTLE MATTERHORN, 12,750 FEET, 10 HOURS

More snow made it necessary to wait in the valley again now for three days, and then to content ourselves with the Breithorn, which was a short and very beautiful snow climb. The ascent of



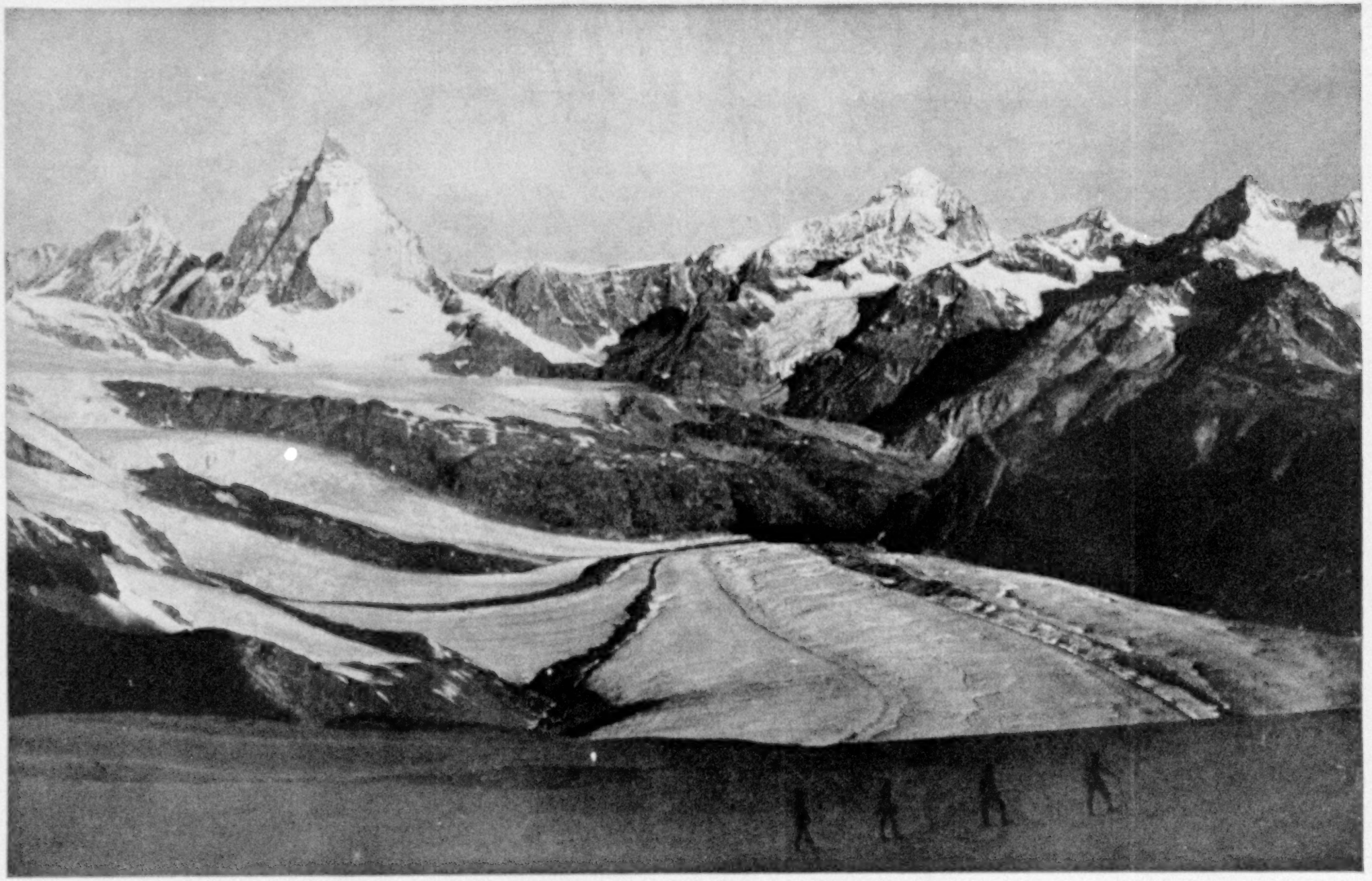
THE DIFFICULT WEISSHORN

Leaving the hut at 2.30 a. m., by full moon, we needed no lantern. Monte Rosa and the Matterhorn rose far away like specters. Just as we stopped for breakfast, at 6 a. m., the sun rose. From there up (see cross) the "gendarmes" took two hours, and two more up the snow cornice to the top (see page 660). Photo by Wehrli, Kilchberg-Zurich.



IT WAS DOWN SUCH A SNOW-SLOPE THAT I FEARED TO SLIP IN DESCENDING FROM THE SUMMIT OF THE WEISSHORN, 14,804 FEET

This is the Obergabelhorn, also a difficult ascent. Its ascent is made by the left ridge. The southern side is bare and steep. Another view of the Obergabelhorn is shown in panorama of the Matterhorn, page 659. Photo by A. G. Wehrli.



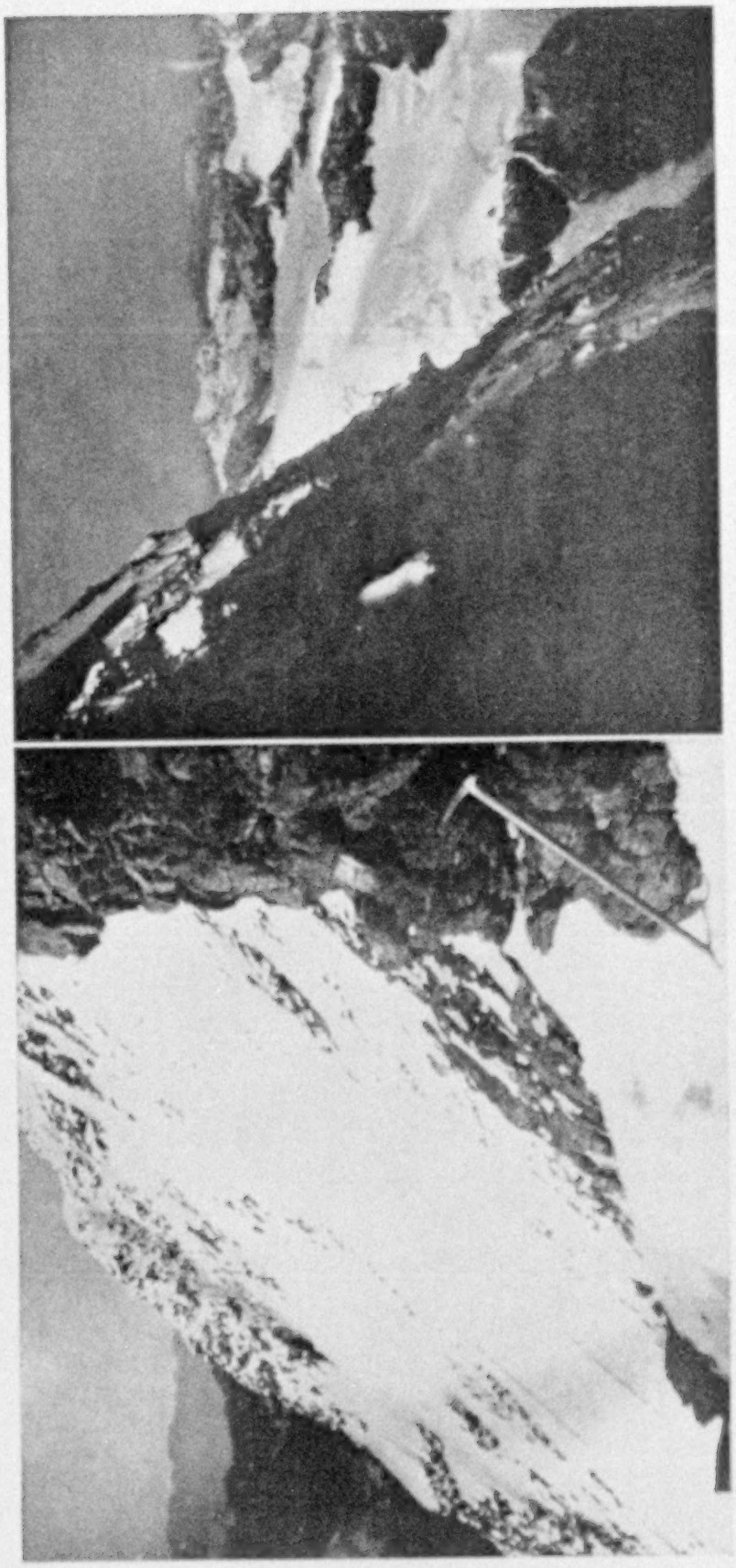
THE MATTERHORN AS WE HAD IT—A MASS OF SNOW: AT ITS RIGHT THE DENT BLANCHE (SEE PAGE 661)

Our ascent of the Matterhorn was from the Schwarzsee Hotel, at the end of the grassy slope, up the right ridge to the summit, and down again. It took 10½ hours, because of the snow, and 16½ were hard work. In a month I had progressed from the little Riffelhorn, seen over the men's heads as it rises above the Gornergletscher, to this. Photo by A. G. Wehrli.

seen over the men's heads as it rises above the Gornergletscher, to this. Photo by A. G. Wehrli.

THE SUMMIT OF THE MATTERHORN IS A RIDGE-HOLE

It was a cornice of snow the day of our ascent. Note the dominance, and how steep are the rocks between the shoulder (the white patch on the left ridge) and the top. The ropes are there (see page 663). The Obergabelhorn (right) shows the difference between the north side of a mountain which is snow-covered—unless too steep—and its bare southern side (see also 648). Dotted lines indicate our route up the Wellenkuffe (see page 647), whose snow-cap is always recognizable from the Trift Glacier, with very little snow. Photo by G. P. Abrahams.



ON THE RIDGE OF THE MATTERHORN: THE TWO FACES

It seemed just as steep as it looked. The snowy side was the less steep and also less cold, because in the sun, and as far as the "shoulder," protected from the north wind. Photo by Dora Keen

this "Damenspitze," or "ladies' mountain," was cold, if easy. It was only four hours over snow to the top and most of the way at an easy grade, with few crevasses (see picture, page 655), yet three of the 20 caravanes that day turned back, because of women's feet too thinly protected from freezing. By 6 a. m. one has usually attained the final exposed ridge of any mountain, and the chilling sunrise breeze is apt to make the time from 6 to 8, until at last the sun begins to give some heat, an anxious time for feet or hands.

THE WEISSHORN, 14,804 FEET, 15 HOURS

Not until a week later, after having been twice repulsed by more bad weather, once when half way up, did conditions permit me to reach the top of the Weisshorn. At its base, above the valley, stands the unoccupied hut, on a site whence the views, whether after a storm, by Alpine glow, or by full moonlight, are among the finest I have ever had (see picture, page 646). The first half of the ascent was not especially difficult; but after three hours and a half of a comparatively easy glacier, snow, and steep rock slopes, we came to a rock ridge whose steep and jagged points so effectually challenge progress that they are termed the "gendarmes" (see picture, page 656).

The Weisshorn is a few feet higher than the Matterhorn, and a steep ridge most of the way, although not as steep as the latter. It has few snow slopes of safe enough grade for a "glissade," or sliding descent, and consequently the descent, as well as the ascent, takes a long time. It is considered a very difficult climb, and with the great quantity of fresh powdery snow way down to its base, it was certainly twice as hard as

the Rothorn. Baedeker puts them both, together with three others at Zermatt—the Ober-Gabelhorn, Dent Blanche, the worst, and the Dent d'Hérens—as "very difficult (for thorough experts only, with first-rate guides)".

Because of its condition, soon after we reached the rocks it was clear that we must abandon our plan to "traverse" it—that is, to descend into a different valley by its other, steeper, side. Just to reach the top took eight hours of anxious and very fatiguing work, and a light snow-storm and clouds, which veiled all views for the last two hours, chilled us even as we toiled. In endless series the "gendarmes" seemed to rise, and to climb them was a two-hour task.

At times the only way to get up at all was for the first guide and me in turn to mount to the shoulders of the second guide. I would then stand aside while he was pulled up by the rope. This was labor, but worse yet were the last two hours, for the top is a pyramid of snow, as the name implies, and to climb its ridge meant nice judgment to determine how to go most safely between an overhanging edge or snow "cornice," which might break off with our weight if we got too far over on it, and a slope so steep on the other side that to miss a step might mean to slide to the bottom. While we were waiting for the steps to be cut we grew cold, and when we went forward I panted from the steepness.

But more anxious still was the descent from this snowy summit, for at every reach to the next step, far below, it seemed as if I should certainly lose my balance or slip. The descent of the "gendarmes" was difficult, too, but to climb down at least is no such strain on one's breathing powers as to climb up, so that to me it is always worse to go up. Finally came a couloir, or gully, in which several flying stones from a caravane behind made us take refuge under a rock until they also were down. "Killed on the Weisshorn by a falling stone" I had read two days before on a grave in the English church-yard. The Dent Blanche is called the worst climb at Zermatt, but my guides assured me that it was hardly worse—a little longer, but of the same character.

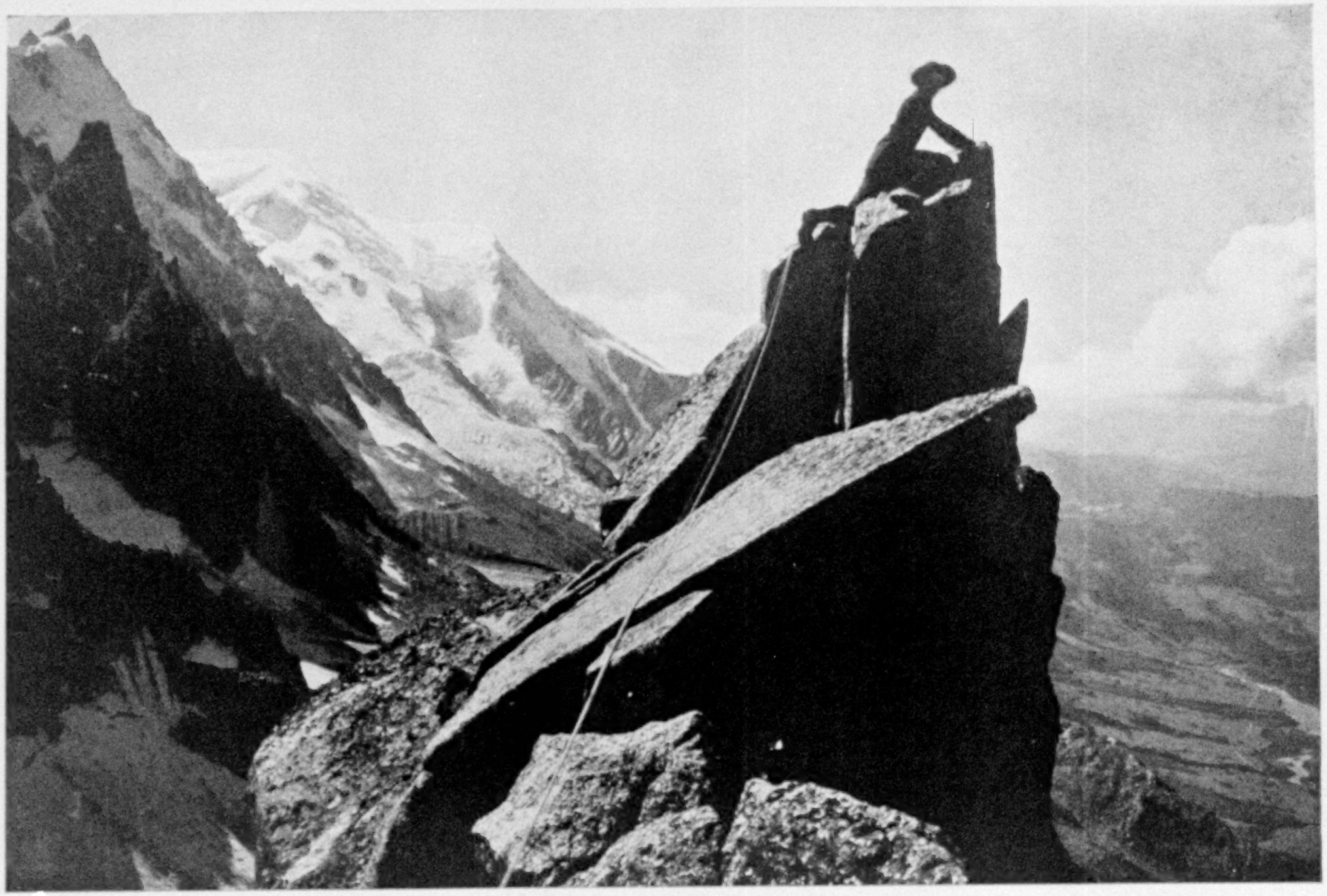
THE MATTERHORN, 14,780 FEET, 19½ HOURS

Again it stormed and shone again, so it was September 6 before I could at last start for the Schwarzsee Hotel, two hours above Zermatt, and the next morning up the Matterhorn (see pictures, pages 658, 659, and 660). My guides urged that it would be better to wait for another day's sun to do its work, but they thought it could now be ascended safely, and I did not trust the weather. The season was now so late that I preferred harder work to the risk of not getting up at all. Eight other parties had likewise been waiting from two to three weeks, but all decided to wait another day. All the next day they watched us by telescope, and when they saw that we had succeeded they all welcomed us at the base hut, whither they had mounted, ready to profit by our step-cutting by going up on the day following.

Profit they did and had much less snow—even as we came down at night the lower stretches had melted—but for them the mountain was enveloped in clouds after 7 a. m., and I was glad that I had not waited.

One of my guides had an ugly scar from a falling stone that had nearly killed him on the Matterhorn, and this was one of my reasons for preferring to go when not many others were going. In fact, there was only one other caravane on the mountain with me, that of the president of the Swiss Alpine Club, and he had to turn around exhausted within an hour of the summit.

Under good conditions the Matterhorn is not now reckoned as presenting extraordinary difficulties to experienced climbers in good training, but it is "immer anstrengend," as the Germans say. It is always a great strain, a great test of endurance, because it is hard every minute, is very high above the hut, and takes almost as long to come down as to go up. This is the case under all conditions, and now, care and step-cutting over, so much



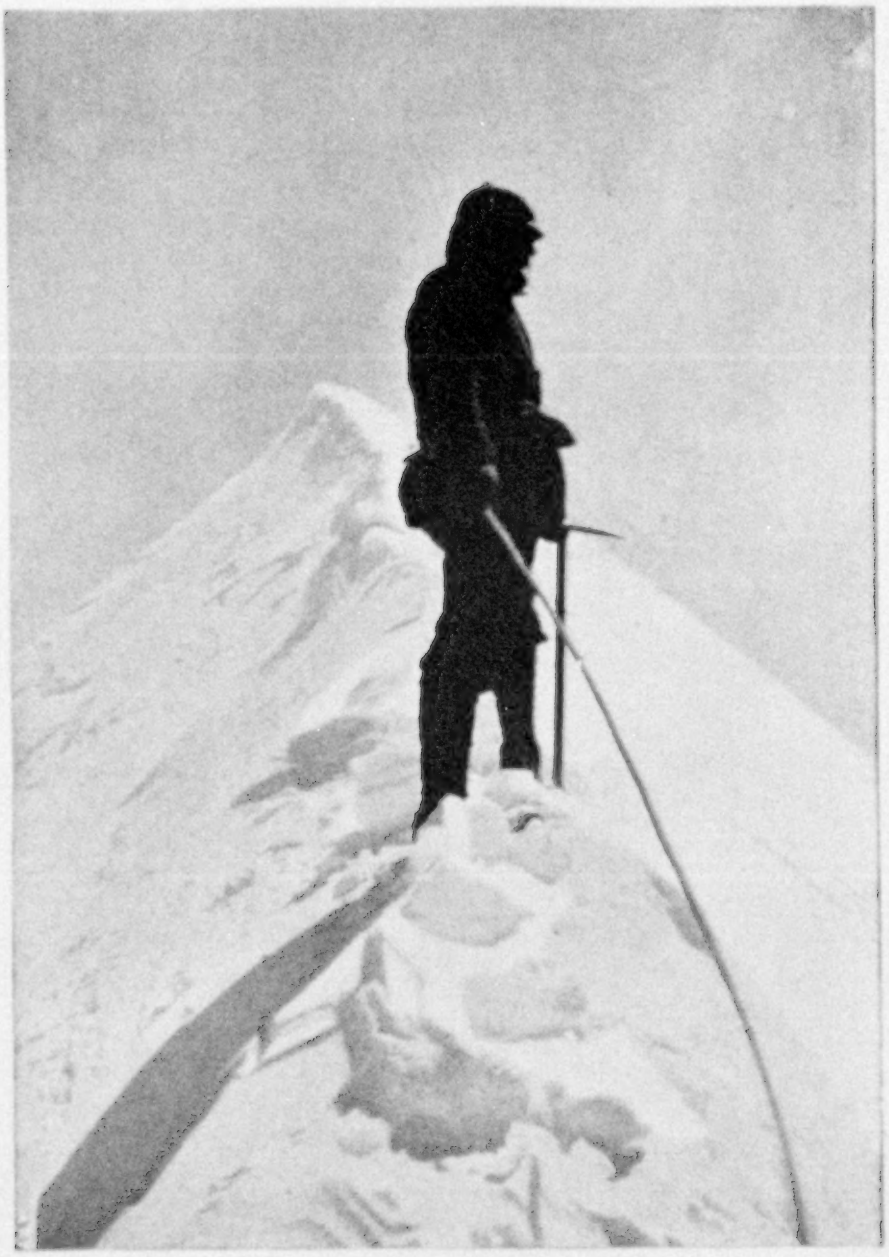
OUR FIRST ROCK CLIMB AT CHEMONIX, JUST FOR PRACTICE

While we were climbing this Aiguille de l'M, 9,302 feet (see page 669), and the twin Aiguille des Petits Charmoz, 9,409 feet, flitting mists gave occasional glimpses of these two lower points of Mont Blanc and of the Aiguille du Midi above. Photo by Dora Keen

snow made it much longer and more anxious.

We were 19½ hours from hotel to summit and back, and 16 of them meant continuous hard muscular effort. From 4 a. m. to 8 p. m. I was pulling myself up or letting myself down the rocks by sheer force of muscle, never stopping except a few times for a few moments to take a hasty meal or a hasty snapshot. Starting at 2 a. m. and going as fast as caution and breath would permit, it was 1 p. m. when we reached the summit and 8 p. m. when we got off the rocks. There were no easy bits and never a place to make time by "glissering"; that is, sliding erect down snow. It was a constant reach and tug, on holds that often seemed impossible for me to reach.

There is no shelter after the base hut, and this was a miserable shanty only two hours above the hotel, still 4,000 feet below the summit. An old hut two hours up on the rocks is ice-filled. On the Italian side there is an Italian Alpine Club Refuge at 12,763 feet, only 2,000 feet below the top. By this harder side I had wished to descend; but, as on the Weisshorn, conditions now made this "traverse" impossible.



WHAT I TOOK TO BE THE SUMMIT OF MONT BLANC

It proved to be another 40 minutes to the real summit, and the altitude was beginning to make me go more slowly. My guide stands sure. He never slips, and he has the work of making the steps. Photo by Dora Keen.

From Zermatt the ascent is right up the northeast ridge, the one that is nearest in the familiar view of the mountain. One point is named for a man who lost his life there. Two-thirds of the way up is a break that appears as a white patch at the right in the pictures. This is "the shoulder," and this we reached at 10 a. m., eight hours going and all the worst still ahead (see picture, page 659). Here ropes have been attached to stanchions 40 feet apart, for this slope is usually glare ice on which "crampons," or climbing irons, are useful. But now, for half the three-quarters of an hour across this part, the ropes were out of reach, buried under two feet of snow. It was steep and every step had to be cut; but at least it was not glare ice. This brought us to the worst part of all, the almost perpendicular ascent of an hour and a half, where ropes only help a panting struggle.

"Are you tired?" my leader constantly asked, as I had to gasp for breath a mo-

BEFORE STARTING DOWN THE GLACIER DU DÔME (MONT BLANC) WE STOPPED TO ENJOY THE VIEW OF ITALY, AND TO DISCARD WRAPS

We had already been descending from the summit for three hours. Over the standing guide rises the beautiful and difficult Aiguille de Trélatête, 12,830 feet. Photo by Dora Keen

ON THE FINAL "EASY" GRADE OF THE STEEP SNOW CORNICE (MONT BLANC) WE HAD TO PASS TWO EXHAUSTED GERMANS

It is such guideless climbers as these that get into trouble. They had about two hours more to climb to the fireless Refuge Vallot. From here we went straight down. Photo by Dora Keen.

ment after some 20 or 30 foot sheer climb. It was like going up a wall, pulling with both hands on the fixed rope and feeling about for the occasional footholds. But just a moment's halt to regain my breath was all I ever needed, and at last we gained the final steep and snowy rock-pile, up which there are no ropes. All the way from the shoulder to the top one is exposed to the bitter north wind. The summit was now a cornice of snow, an overhanging shelf, up and down and along which we had to walk for 20 minutes to reach the highest point. The wind came in freezing gusts.

Twice the guides reached quickly toward me, fearful that I would be blown off my feet, as I took my hand off my ice-pick to use my camera. So cold was it and so windy on top that after all our exertion we could not stop to eat, and there was no other place to stop until we were past the shoulder again. The difficulties of changing films, adjusting a color screen, and of photography in general may be imagined.

After ten minutes we could stand it no longer. It was late, too, and the leader asked me to take no more pictures that day. To go down the rocks to the ropes was appalling at times, so steep and slippery were they. It was here that the fatal accident occurred on the first ascent. But, once at the ropes, we could take occasional short slides down them, cautiously, lest we miss the footholds at the end of each bit. Down, down, down we went for eight hours. At 7.30 it grew quite dark, but we feared the deceptive shadows should we light the lantern. By 8 o'clock we were off the rocks, and at 9.30 back at the hotel, my clothes torn to shreds, but not really tired except a

The author and her two guides preparing to leave the Rifugio Torino, 10,900 feet, below the Col du Géant, for the Dent du Géant (see page 671).

The goggles and mask are to protect eyes, face, and lips from snow blindness and blistering when on snow on which the sun is shining. The woolen cap will pull down like a helmet. Mittens are of the heaviest wool. Boots are rawhide, with half-inch soles and nails. Puttees, or cloth bands, are wound around from ankle to knee to give warmth, and to keep snow and stones from getting into the boots, causing blistered feet. All clothing is of warm, light wool, including two very thick pairs of stockings. The rope is 100 feet long, to give 50 feet of leeway between each two persons for difficult climbing. The tourist is always in the center. The head guide is about to tie his end around his waist also.

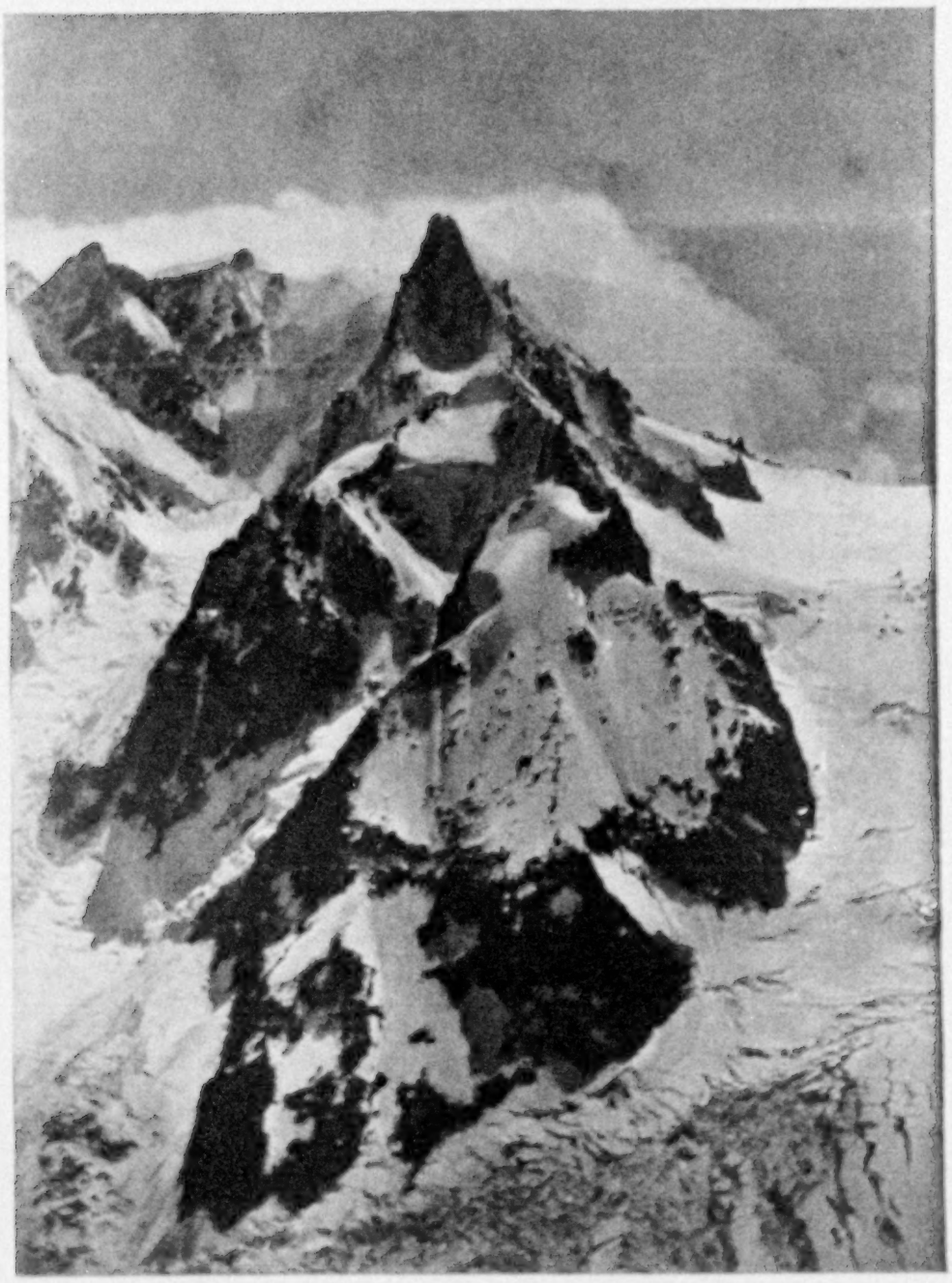
THE DENT DU GÉANT FROM BELOW: OUR ASCENT WAS BY THE RIGHT RIDGE (SEE PAGE 671)

The left can be climbed only where, as here, it is free from snow. What I remember chiefly is a sense of awful struggle; of straining; of pulling myself up by my arms; of feeling about with my feet, feebly, desperately, vainly, for points on which to get even a toehold. But the sense of exhilaration at the top is proportionate. Photo by Wehrli, Kilchberg-Zurich.

little in the knees, from the long descent, and at 6 the next morning we were off for Zermatt, I to pack up and leave that day.

CHAMONIX

I had thought the Zermatt climbs difficult and exhilarating. Exercise I had certainly had. Harder peaks, steeper and far worse snow, and even worse weather were to give me much more thrilling experiences the next season at Chamonix, France. I wanted to climb the famous "Aiguilles," or rock needles, of the chain of Mont Blanc, but my arrival on the 20th of July, 1910, found the winter's snow still deeper and further down on the mountains than it had been at Zermatt. Few climbers had ventured to come, and some had gone away in dismay at the conditions. Instead of improving, they grew continually worse, for there were even fewer clear days than there had been at Zermatt.



THE DENT DU GÉANT FROM ACROSS THE GLACIER DU GÉANT, 4,000 FEET BELOW ITS SUMMIT

This is from the shoulder of the Requin opposite. Photo by Dora Keen

In three and a half weeks I was able to make only seven ascents and only four first-class ones—Mt. Blanc, the Dent du Géant, the Aiguille des Grands Charmoz, and the Dent du Requin. To these four must I confine myself. Throughout my stay, the two hardest ascents at Chamonix, those of the Aiguille du Petit Dru and the Aiguille de Grépon, continued to be quite out of the question.

Warned by the previous year's frequent storms, on the day after my arrival I started at once for a climb high enough to make me a little stiff, as it did, being the first one, but neither very high nor very hard. We had chosen La Glière (9,353 feet, 5½ hours), one of the Aiguilles Rouges, on the other side of the valley from Mont Blanc, for this first practice climb. Usually bare of snow at this season, this year it afforded practice on snow and rocks alike.

CLIMBING THE GIANT'S TOOTH (SEE PAGE 671)

Seated on the higher point of the Dent du Géant, which was like the point to the left, I snapped this view of another caravane of four people climbing up the lower peak in order to climb down the 500-foot tower on its other side. It was snowing and blowing, and the Mount Mandit across is three miles away. An English girl is climbing, while her brother and the porter above and the guide below hold on. The porter is taking up the slack in the rope lest she slip. Her mother in Courmayeur can watch all but this part of her ascent by telescope. Photo by Dora Keen

THE AIGUILLE DE L'M, 9,302 FEET, AND THE AIGUILLE DES PETITS CHARMOZ, 9,409 FEET, 9 HOURS

Next came what is termed "a nice little climb," the comparatively difficult and interesting but short rock climbs of the Aiguille de l'M (see picture, page 662) and the adjoining Aiguille des Petits Charmoz.

MT. BLANC, 15,782 FEET, 19½ HOURS

While not of "first class," these two days' climbs had each meant an ascent of 6,000 feet above the Valley of Chamonix, and all the muscles had been exercised. A day of rain had intervened between them, and fearing that the weather would again break, my guides started me off the very next day, my fifth at Chamonix, on a hard six-day tour which was to include Mt. Blanc (see picture, page 652) and two of the hardest of the Aiguilles.

The ascent of Mt. Blanc from Chamonix is not difficult. There are no rocks. Because of the cold and stormy weather the Glacier des Bossons, in the middle of which is the half-way cabin, was in such good condition that the crevasses had hardly had a chance to open and were still filled with snow. The only very steep parts of the ascent are near the top, on the second day. The first day's ascent lasted only seven hours. When we rose again at midnight, wind, clouds, and the promise of snow made it improbable that we would be able to reach the top, so we stayed comfortably at the Grands Mulets cabin until the next day. Two caravanes that tried for the top got only as far as the last hut, two hours below the top, and back again, for it blew and snowed the whole day; but we were not coming back, and would have had to stay miserably in a cold hut.

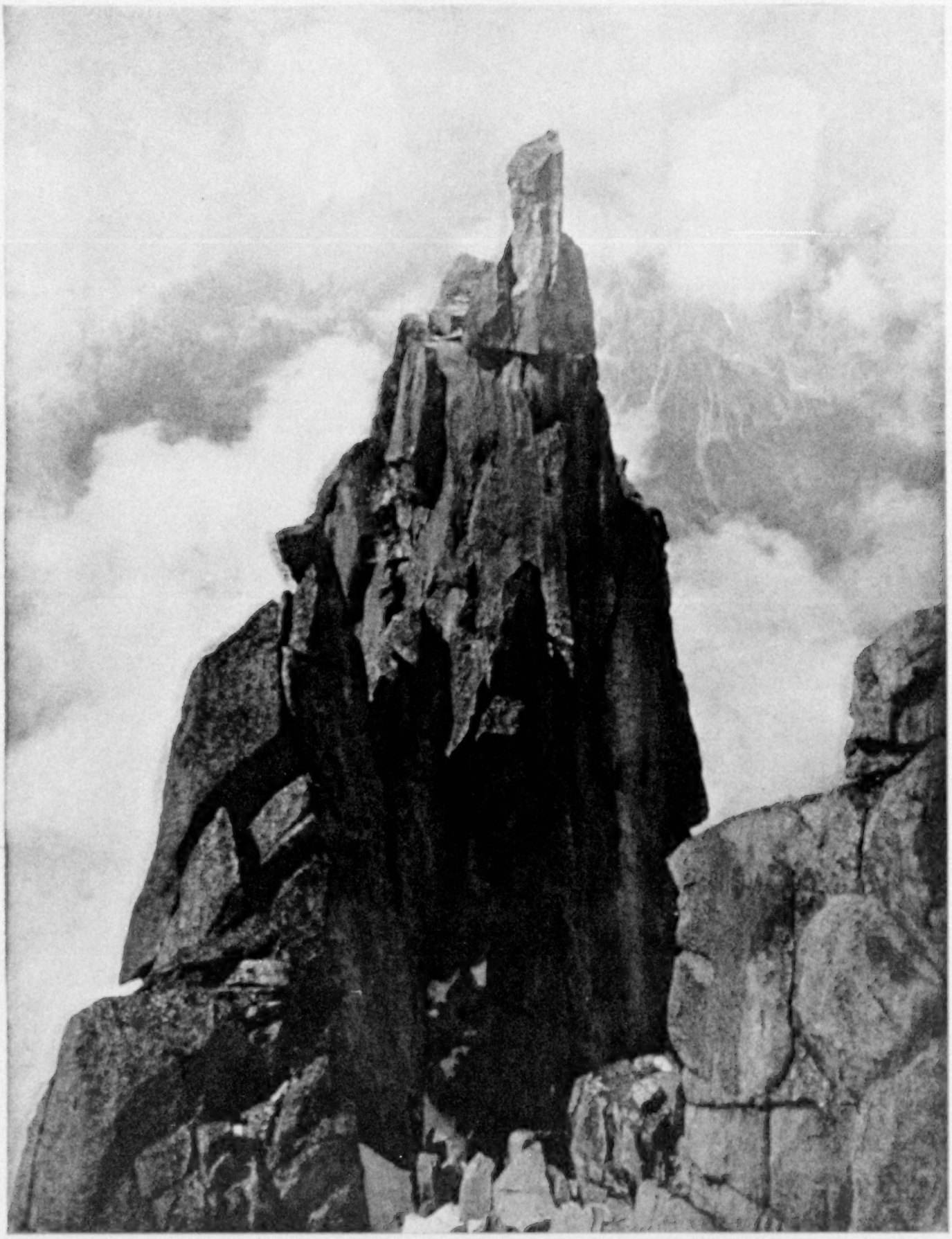
The only real danger on Mt. Blanc is from sudden storms, for the whole of the second day's route, up to the top and down again to Chamonix, is on snow, and the beaten tracks quickly become obliterated. If one strays far in the wrong direction, he will get among impassable crevasses, or will come too near to the slopes at the side and may be overwhelmed by avalanches of snow and ice from them; or he may perish from cold.

The ascent from the Grands Mulets to the Refuge Vallot above takes four or five hours, in good weather, and to the tiny summit observatory is another two hours. The Refuge Vallot has mattresses and blankets, but no wood and no food, and its altitude is 14,312 feet. With the best of conditions, the ascent is, therefore, a long pull, and for the last few hours very cold, because all snow and so high.

Hence it is never safe to start for the top without extra warm wraps, special protection for the feet, and a two days' supply of food. Because of the number of people that have been lost, one short section of the route has now been staked, yet shortly after my ascent two caravanes nearly perished far above this point, both from bad judgment. Many people go as far as the Grands Mulets, but one-third of those that start thence for the top turn back at the Grand Plateau, 12,900 feet, when two-thirds of the way up, for there it is that the freezing, the mountain sickness, heart failure, violent headache, or difficult breathing begins.

Starting from the Grands Mulets at 2.45 a. m., we went as fast as was possible over the fresh snow, up and up amid fairy-like scenes first of full moonlight, then of dawn, and finally of sunrise on the massive stretches and slopes and summits of snow on every side. In seven hours we had reached the top, inclusive of about an hour and a half of stops, to eat, to make adjustments, and to photograph. From the Grand Plateau on, it had been intensely cold. I had a violent headache, and the wind was piercing.

Above 15,000 feet I began to breathe less easily and could not continue to go quite so fast. The day was superb, and we were the only caravane. But we could linger only a half hour at the top, for we were to make the long and for a time difficult descent by the Italian side. A snow-covered ice cornice of great



THE SUMMIT OF THE GRANDS CHARMOZ FROM THE GRÉPON (SEE PAGE 671)

These rocks were a mass of snow when we ascended. We went up to the left, around the corner. The chimney is immediately below the summit, but on the other side. Photo by A. G. Wehrli.

steepness took what seemed an interminable half hour to descend. Even step-cutting and crampons did not seem to make it safe from slipping. From it we had to descend the very steep Glacier du Dôme, which was a mass of crevasses at every turn. To descend it thus in the afternoon of a hot day meant plunging to the knees for two hours in soft snow and going in to the hips below every crevasse over which I jumped.

The tiny hut at the foot was already filled by an ascending caravane, so five hours of interminable walking down the Glacier de Miage and over rough ground on a valley path must be added to our day's work. At 10 p. m., 19½ hours after our start, we came into Courmayeur, Italy, 11,800 feet below the summit but not especially tired and with no worse complaint than toes a little sore from the long descent with wet feet. I was the first woman who had reached the top that season and ours the first caravane that had "traversed" Mt. Blanc that year.

THE GIANT'S TOOTH—DENT DU GÉANT—13,170 FEET, 7½ HOURS

By 4.30 the next morning I was awake again, rested and ready to start later in the day for the formidable Dent du Géant, or Giant's Tooth. From Courmayeur to the Col du Géant, the snow-pass from which the ascent was to be made, was a five-hour climb, first up a steep path, then over easy snow slopes and snowy rocks. We intended to spend two nights at the Col; that is, after ascending the Dent du Géant, to return to the Italian Alpine Club's Refuge below the Col, in order to climb the Requin en route to Chamonix the next day. The ascent of the Géant was thus to be a short one. Only an hour of level snow was to be crossed, so this time there was no need for an early start.

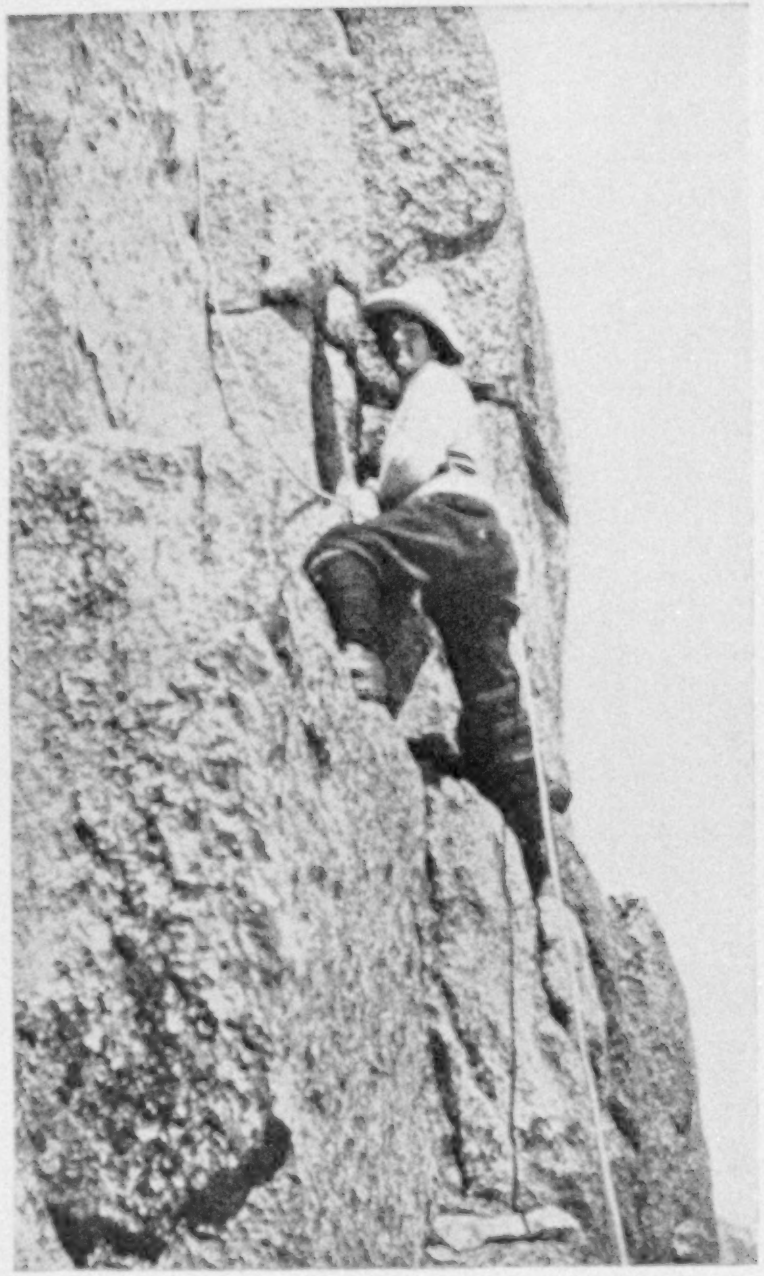
After the snow stretch that lay between the Col and the base of the "tooth" there came three-quarters of an hour of steep, snowy rocks and then nearly two hours of the most exhausting work that I have ever done. The tooth, or rock tower, rises almost perpendicularly 500 feet in the air (see pictures, pages 666, 667, and 668). A few fixed cables there are, but they are poor substitutes for a firm grip on rock. They hang loosely and were sometimes above my reach.

Harder than the Matterhorn was this Aiguille, while it lasted. To find a handhold or foothold, to step or kneel as high as one could, to reach as far and pull as hard as one could, in order to lift one's self up—this was what it meant, and withal hurried, when already gasping, or cut in two by the rope of a well-meaning but overzealous guide above. Once on top, he explained that the snowstorm in which we were now climbing might turn into an electrical storm, and two guides had once been struck by lightning on this Aiguille. But once down, the strain and the anxiety over, I was not tired, for there had been only five hours of great effort or care, and altogether we had been out only 7¼ hours.

The Dent du Requin is not as high as the Dent du Géant, but its ascent is longer, because it is further from any base, and its "needle" is an even sharper point, with no ropes to pull on. After we had waited 24 hours at the Col for the snow to cease, clearly the Requin could not be done, so down to Chamonix we went—down the full length of the beautiful Mer de Glace, for its upper part, above the Géant, is beautiful, very different from its dirty tongue at the Montanvert.

AIGUILLE DES GRANDS CHARMOZ, 11,293 FEET, 13½ HOURS

Twenty-four hours of sunshine started us up again the next day for the hard Aiguille des Grands Charmoz (see picture, page 670); but it was with clouds and uncertain weather that we set out the day following, and conditions proved to be very bad, indeed. The route to the base was the same as for the Petits Charmoz before. Instead of the short snow couloir to the latter, we had now, however, to ascend the worst glacier I have ever been on. The Glacier des



CLIMBING UP THE TOP OF THE DENT DU REQUIN

The author, starting up the "chimney," or crack, down which the rope comes. It was held taut by the leader, well braced at the top of the chimney, 40 feet above, so that when my foot slipped half way I was in no danger and at once recovered my footing (see page 674). Photo by author's second guide.

FIFTY FEET MORE TO THE TOP OF THE REQUIN

Above the chimney. With good handholds, solid footing for the right foot, and the left knee as high as I can reach, it is only hard work to pull myself up the rocks. Much worse had it been to cross the soft, steep snowdrift below, with fear that it might avalanche, and no holds whatever on the rock at its side. Photo by author's second guide.

Nantillons must be mounted and descended, part of the way right in the track of possible avalanches from its rotten cliffs.

Being only five feet tall, the chief difficulty I have in mountain climbing is in being so much shorter than my guides that I fail to reach. Steep snow, on which I must keep exactly in their steps, for safety and speed, is therefore much harder for me than rocks. Instead of letting me follow my normal pace, laboring as I always had to on snow in order to stride in the steps of my tall leader, he had no mercy, but fairly dragged me along by the rope. He had no choice. It would not do to go under and across where we were going except at a most rapid pace.

Nor was this the worst. Above the glacier, on one side rise the very steep snow slopes of the twin Aiguille des Grands Charmoz and the Aiguille de Grépon, on the other the Aiguille de Blaitière, and the snow on their steep slopes lay not only deep, but soft, and hence ready to slide. To gain the crotch between the Chermoz and the Grépon, from which both are ascended, required an hour's ascent of a couloir of snow which was soft enough and steep enough to put us in constant dread of our weight starting a whole mass down. Every step had to be kicked in as far as the foot would go, and far above the last one, so as not to have any step undermined by the one below. It was as steep as a ladder and just like one. The steps above were the only handholds, and the pick must be plunged to its hilt and far to one side at every step in order to be out of the line of pressure in case of need to hold to it.

At the top came rocks, already steep and difficult enough, and now made slippery by deep snowdrifts, and finally a summit chimney, up which I could not reach a single hold and had to be pulled for some 20 feet. The descent was even worse, for before we could get down, midway on the snow couloir, a fierce sun came full on it, increasing its softness and our concern lest it avalanche. Never more than ten minutes did we stop the whole day, and as I used those minutes to photograph, I had had no more than a bite to eat for 12 hours, when at last, at 2 p. m., we reached the end of the snow.

One of the many crevasses on the steep Glacier du Plan, which we could not easily cross and with difficulty got around (see page 674). Photo by Dora Keen.

COL DES GRANDES MONTETS, 10,634 FEET, 11 HOURS

More rain and snow alternated with briefest sunshine. One unsuccessful attempt of eight hours was made on the Requin, and finally, while waiting for the snow on it to melt, we set out for a very fine snow pass, the Col des Grands

Montets. Although high, this ascent involved no rocks. It was therefore possible even now, and its location under the Aiguille Verte and the Aiguille du Dru afforded wonderful views of both, as well as a superb view of "The Aiguilles," with Mt. Blanc for a background.

DENT DU REQUIN, 11,214 FEET, 17½ HOURS

The ascent of the Aiguille, or Dent du Requin, "The Shark's Tooth," ranks as the third hardest at Chamonix. The approach was long—three hours up the Mer de Glace, two hours up the steep Glacier du Plan, and finally, two hours along the face of snowy and precipitous rocks. On the Glacier du Plan it had been hard to find a way among the deep crevasses (see picture, page 673), which were on every side and were filled or covered with treacherous snow. Occasionally one of us would sink in to the waist. But the rocks were far worse. Generally bare, we must now take two hours to reach the "shoulder," instead of the usual 40 minutes, for every step across the snow had to be pounded before venturing to tread on it. Even then every fifth step would give way from under our very feet. Only one person could move at a time, and we had to be careful every moment in order not to go down in the small avalanches that we started.

It was 10.45 under a hot sun, seven hours since the start, when we began the acrobatic and difficult ascent to the summit. We saw it close by, and not much higher up; yet it took two hours to reach it in safety, and an hour and a half to get back from the top to the shoulder. Moreover we "traversed" it, and to come down the steeper side involved a chimney, or crack, 115 feet deep. A heavy rope carried along all day—and on the previous six-day tour—for just this purpose was doubled over a projecting rock at the top, and each person in turn slid down it to a ledge half way. Since to carry a rope longer than 115 feet would be too heavy, and loose it must be, in order to be pulled down again, an iron staple had here been driven into the rock. On the slanting, slippery, small shelf opposite it three must find lodgment while the rope was pulled down and doubled over the staple for the other half of the descent.

It was thus 2.45 p. m. by the time we started down from the shoulder. For two hours we had been hearing avalanches on every side every few minutes, and this was our real anxiety. Just as carefully as we had come up must we go down the precipitous base rocks, for now the snow was softer, therefore more ready to loosen itself from the rocks and slide. This was, in fact, what actually happened.

Three times did I see the guide below me, to whom I was roped, sliding down, 10, 15, or 20 feet, carried down by snow that had been too soft to bear his weight. But each time he wheeled as he slid slowly down, dug his ice-pick into the snow far above his head, stopped himself, and climbed up without once dragging me down. A truly thrilling day had it been, and 17½ hours long by the time we got back to the Montanvert.

CONTRASTS

In summarizing and contrasting these 16 climbs, I should rank the Matterhorn as the hardest, because it was so long under the conditions that we had, and was hard all the time, but the Chamonix guides do not admit that it is harder than the Aiguilles. In general, except for the Matterhorn, the ascents at Chamonix were harder, more interesting, and more of an anxious strain than those at Zermatt. If one wishes to convince himself of this he has only to consult the tariff for guides for these different ascents as given in Bædeker. The worst ones at Chamonix are more expensive than the worst at Zermatt, because harder and involving more risk, and the very worst at Chamonix have no tariff. Even Mt. Blanc, as we did it, was a 19½-hour day, the coldest, too, and some hours of it were anxious because of the descent by the Italian side. Monte Rosa and the Weisshorn were also hard. But

the hardest exertion of all was probably on the short Dent du Géant, the most continuous anxiety on the Grands Charmoz, and the most thrilling and most interesting experiences on the Dent du Requin. As for views, too, perhaps the Requin was the finest, although they were quite different in character and perhaps not more beautiful than those on Monte Rosa and Mt. Blanc. Clouds veiled the views on the Weisshorn and the Grands Chermoz, but views through mist and peeps through flitting clouds have the added charm of mystery and constant variety.

How one climbs, why one feels that it is safe to go on such ascents, what one's sensations actually are, and, above all, what there is to offset such strain and anxiety have hardly been suggested. In so summary a review of merely the chief difficulties of 16 climbs, I cannot hope to have given any of the feeling of the wonders of the High Alps. For even an idea of what it is really like I must trust to the illustrations, and for the rest can only hope that I have aroused enough interest to stimulate the reader's own imagination or to make him wish to find out for himself the rewards of mountain climbing.

OUR FRIENDS, THE BEES

By A. I. Root and E. R. Root

Growing bees for pleasure or profit is one of those American industries whose magnitude is entirely unsuspected by the average citizen. According to a recent report there are approximately 800,000 persons keeping bees in the United States, and the annual output of honey and beeswax is estimated as worth $22,000,000. One reason that bee-keeping is so popular in this country is that American ingenuity has invented many devices which simplify the work and enable the owner at all times readily to ascertain the health of his bee colony (see pictures, pages 680-683). The following article and photographs are from "The A B C and X Y Z of Bee Culture," by A. I. Root and E. R. Root. The Root family, of Medina, Ohio, are practical apiarists, who have been studying and keeping bees for 40 years and who have originated many of the methods and apparatus that are used by thousands of bee-lovers in all parts of the world. Their book, which may be justly called "a cyclopedia of everything pertaining to the care of the honey-bee," contains the results of their long experience and of the observations of tens of thousands of correspondents. It is one of the most fascinating volumes published in a long time. The illustrations, of which there are several hundred, are particularly good.

WE CONFESS we do not like the term "anger," when applied to bees, and it almost makes us angry when we hear people speak of their being "mad," as if they were always in a towering rage and delight to inflict severe pain on everything and everybody coming near them. Bees are, on the contrary, the pleasantest, most sociable, genial, and good-natured little fellows one meets in all animated creation, when one understands them.

Why, we can tear their beautiful comb all to bits right before their very eyes; and without a particle of resentment, but with all the patience in the world, they will at once set to work to repair it, and that, too, without a word of remonstrance. If you pinch them they will sting; and anybody who has energy enough to take care of himself would do as much had he the weapon.

We as yet know comparatively very little of bees, and the more we learn

A DISSECTED BEE-TREE, SHOWING THE MANNER IN WHICH THE BEES ARRANGE THE HONEY-COMB IN THE HOLLOW TRUNK

Fortunately, in this case the swarm was accommodating enough to make the nest close to the ground, where it could be easily captured. Photo from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root.

the easier we find it to be to get along without any clashing in regard to who shall be master. In fact, we take all their honey now, almost as fast as they gather it; and even if we are so thoughtless as to starve them to death, no word of complaint is made.

There are a few circumstances under which bees seem "cross," and, although we may not be able to account exactly for it, we can take precautions to avoid these unpleasant features by a little care. A few years ago a very intelligent friend procured some Italians, an extractor, etc., and commenced bee culture. He soon learned to handle them and succeeded finely. When it came time to extract, the whole business went on so easily that he was surprised at what had been said about experienced hands being needed to do the work.

He had been in the habit of doing this work as directed, toward the middle of the day, while the great mass of the bees were in the fields; but in the midst of a heavy yield of clover honey, when the hives were full to overflowing, they were one day stopped by a heavy thunder shower. This, of course, drove the bees home, and at the same time washed the honey out of the blossoms so completely that they had nothing to do but remain in the hives until more was secreted.

Not so with their energetic and enthusiastic owner. As soon as the rain had ceased, the hives were again opened and an attempt made to take out the frames, as but a few hours before; but the bees that were all gentleness then seemed now possessed of the very spirit of mischief and malice; and when all hands had been severely stung, they concluded that prudence was the better part of valor and stopped operations for the day.

While loads of honey were coming in all the while and every bee rejoicing, none were disposed to be cross; but after the shower all hands were standing around idle, and when a hive was opened each was ready to take a grab from its neighbor, and the result was a free fight in a very short time.

There is nothing in the world that will induce bees to sting with such wicked recklessness as to have them get to quarreling over combs or honey left exposed when they have nothing to do. From a little carelessness in this respect, and nothing else, whole apiaries have been so demoralized that people were stung when passing along the street several rods distant. During the middle of the day, when bees were busily engaged on the flowers during a good yield, we have frequently left filled combs standing on the top of a hive from noon until supper time without a bee touching them; but to do this after a hard rain, or at a time when little or no honey is to be gathered in the fields, might result in the ruin of several colonies and you and your bees being voted a nuisance by the whole neighborhood.

DEMONSTRATING BEES AT FAIRS

The operator begins his performance by stepping inside the cage of live bees and shutting the door behind him. He then tells the crowd that he is going to handle live bees, every one of which is armed with a sting, and, if any one doubts it, to come forward and he will furnish the "proof." He then proceeds to take off his coat and vest and roll up his sleeves, take off his collar, and tuck down his shirt-band.

It will then be necessary for him to put on bicycle pants-guards, or slip his trousers into his stockings. The crowd will quickly appreciate this part of the performance, because the operator tells them the bees will sting if they get inside of his clothing.

With a lighted smoker he opens up the hive. After pulling out the frames he shows the bees and queen on the comb. Then he calls out for everybody to wait and see the next stunt, for he is going to make a swarm. With a large dishpan, which he has previously provided, he shakes two-thirds of the bees off the combs into this pan. Then he takes it up and turns to the crowd, saying: "The bees are not real mad yet, so I'll begin to shake them up to make them

XUM

Photo from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root

A PART OF A FIELD OF DANDELIONS IN FULL BLOOM AT MEDINA, OHIO

so." The people wonder what he is going to do, seeing him barearmed and bareheaded.

He keeps on shaking until he has the bees all in one big ball, and to the uninitiated it *looks* as if they would sting him to death. But no; the continual shaking is the *very thing* that makes them gentle instead of cross.

He now runs his hand under the ball of bees, pushing it under gently, being careful not to pinch any. The movement must be very deliberate—so slow, indeed, that the hand scarcely seems to

move. He picks up a handful and holds them up for the crowd to look at. If he has good nerves he can shake the handful on top of his head and in the meantime pick up another handful.

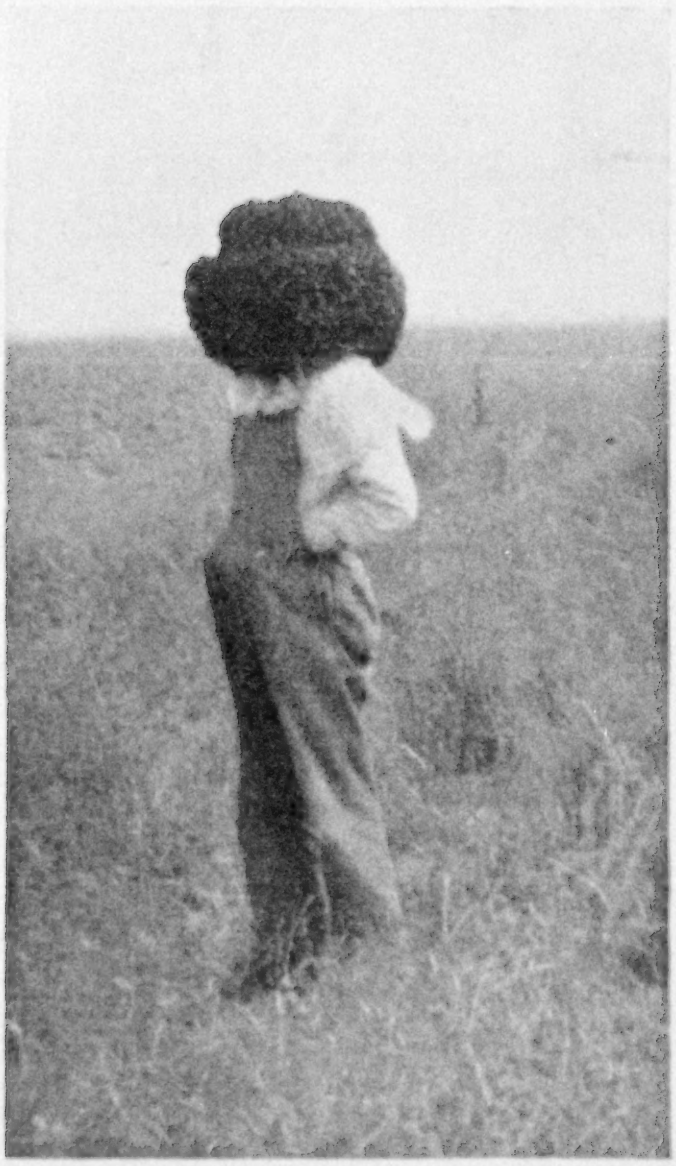


Photo from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root

A LIVE BEE HAT

YOUNG BEES AT WORK

The first day after the young bee gnaws its way out of the cell it does little but crawl around; but about the next day it will be found dipping greedily into the cells of unsealed honey, and so on for a week or more. After about the first day it will also begin to look after the wants of the unsealed larvæ, and very soon assists in furnishing the milky food for them. While doing so a large amount of pollen is used, and it is supposed that this larval food is pollen and honey, partially digested by these young nurses.

Bees of this age, or a little older, supply royal jelly for the queen-cells, which is the same, probably, as the food given very small larvæ. Just before they are sealed up, larvæ to produce worker-bees and drones are fed on a coarser, less perfectly digested mixture of honey and pollen.

Young bees have a white, downy look until they are a full week old, and continue a peculiar young aspect until they are quite two weeks old. At about this latter age they are generally active comb-builders of the hive. When a week or ten days old they take their first flight out of doors. We know no prettier sight in the apiary than a host of young Italians taking a playspell in the open air in front of their hive. Their antics and gambols remind one of a lot of young lambs at play.

It is also very interesting to see these little chaps bringing their first load of pollen from the fields. If there are plenty of other bees in the hive of the proper age, they will not usually take up this work until about two weeks old. The first load of pollen is to a young bee just about what the first pair of pants is to a boy-baby.

Instead of going straight into the hive with its load, as the veterans do, a vast amount of circling round the entrance must be done; and even after the young bee has once alighted it takes wing again before rushing all through the hive, to jostle nurses, drones, and perhaps the queen, too, saying as plainly as could words, "Look! Here am I. I gathered this, all myself. Is it not nice?"

We might imagine some old veteran, who had brought thousands of such loads, answering gruffly, "Well, suppose you did; what of it? You had better put it in a cell and start off after more, instead of making all this row and wasting time, when there are so many mouths to feed."

We said we might imagine this, for we have never been able to find any indication of unkindness inside a beehive.

Photos from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root

LEARNING CONDITION OF HIVE WITHOUT REMOVING COVER OR PULLING TO PIECES

No one scolds or finds fault, and the children are never forced to work. If they are improvident and starvation comes, they all suffer alike, and, we do believe, without a single bit of hard feeling or censure toward any one. They all work together, just as your right hand assists your left, and if we would understand the economy of the beehive, it were well to bear this point in mind.

Shortly following the impulse for pollen-collecting comes that for honey-gathering, and the bee is probably in its prime as a worker when a month old. At this age it can, like a man of 40, "turn its hand" to almost any domestic duties; but if the hive is well supplied with workers of all ages, it now probably does most effective service in the field.

CHARLES MONDENG AND HIS SON NORMAN DEMONSTRATING ADEL BEES AT THE MINNESOTA STATE FAIR

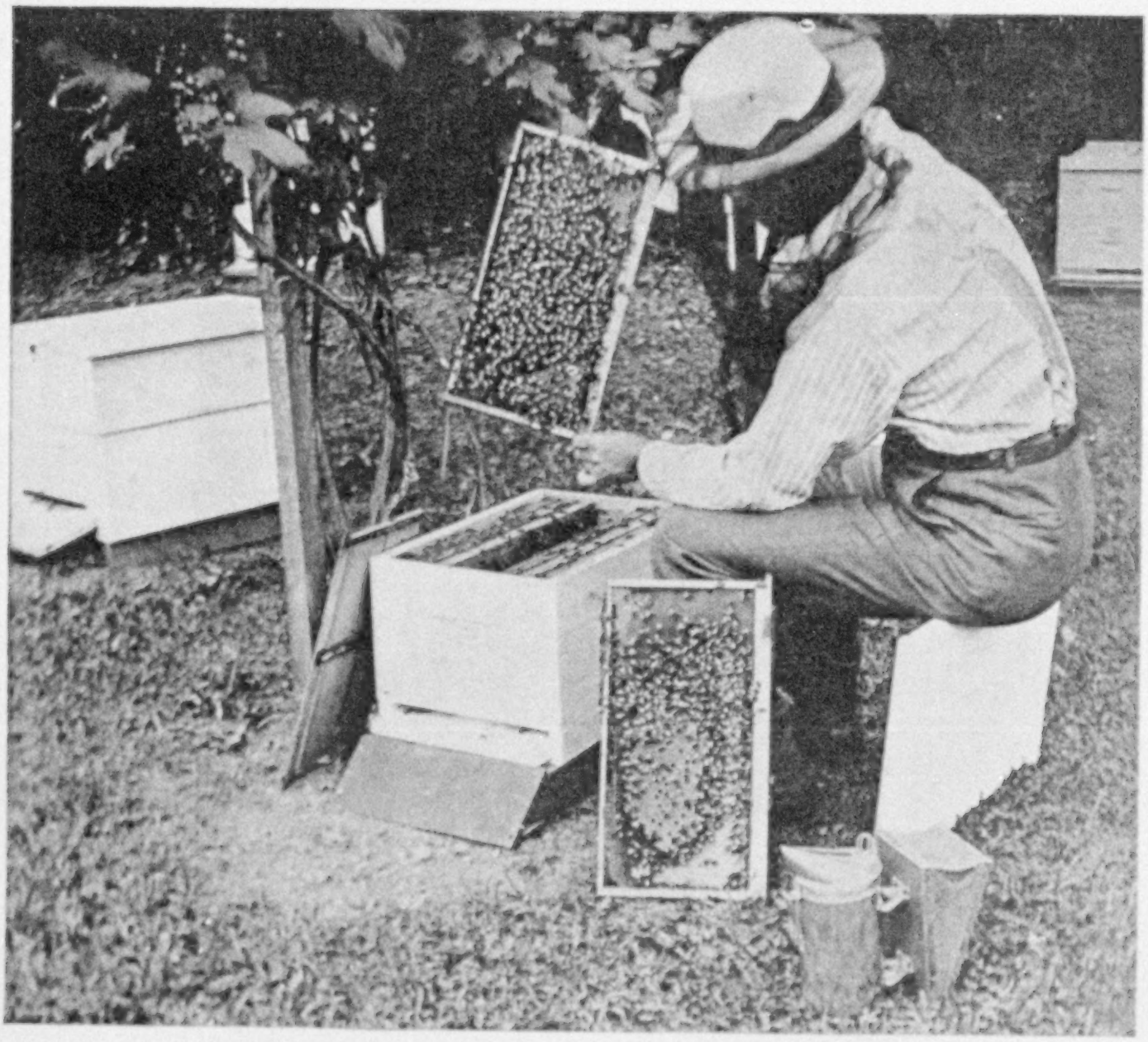
Norman Mondeng is only 11 years old, yet he handles bees without fear. His entire clothing was a bathing suit. Mr. Mondeng and his son were awarded the first prize for bee demonstration—first prize on golden Italian bees and first prize on leather-colored Italian bees. Photo from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root.

BEFORE SWARMING, BEES SEND OUT SCOUTS

Where a colony gets excessively strong, the inmates of the hive, by a sort of preconcerted mutual agreement, divide themselves off into two parties, one remaining in the old hive and the other starting out to seek their fortunes elsewhere.

We have carefully watched this proceeding with a view of determining how the matter comes about; that is, whether it is because a part of the bees become dissatisfied with their old home and seek to better their condition, or because the queen leaves, for some reason of her own (because she has not room to lay her eggs, for instance), and the bees simply follow from a sort of natural instinct, since she is the mother of the colony and an absolute necessity to their prosperity. After seeing a number of swarms issue, and finding that the queen was among the last to leave the hive, we concluded that the bees take the lead, and that the queen simply followed as a matter of course in the general melée.

Suppose, however, that the queen should not take a notion to join the new



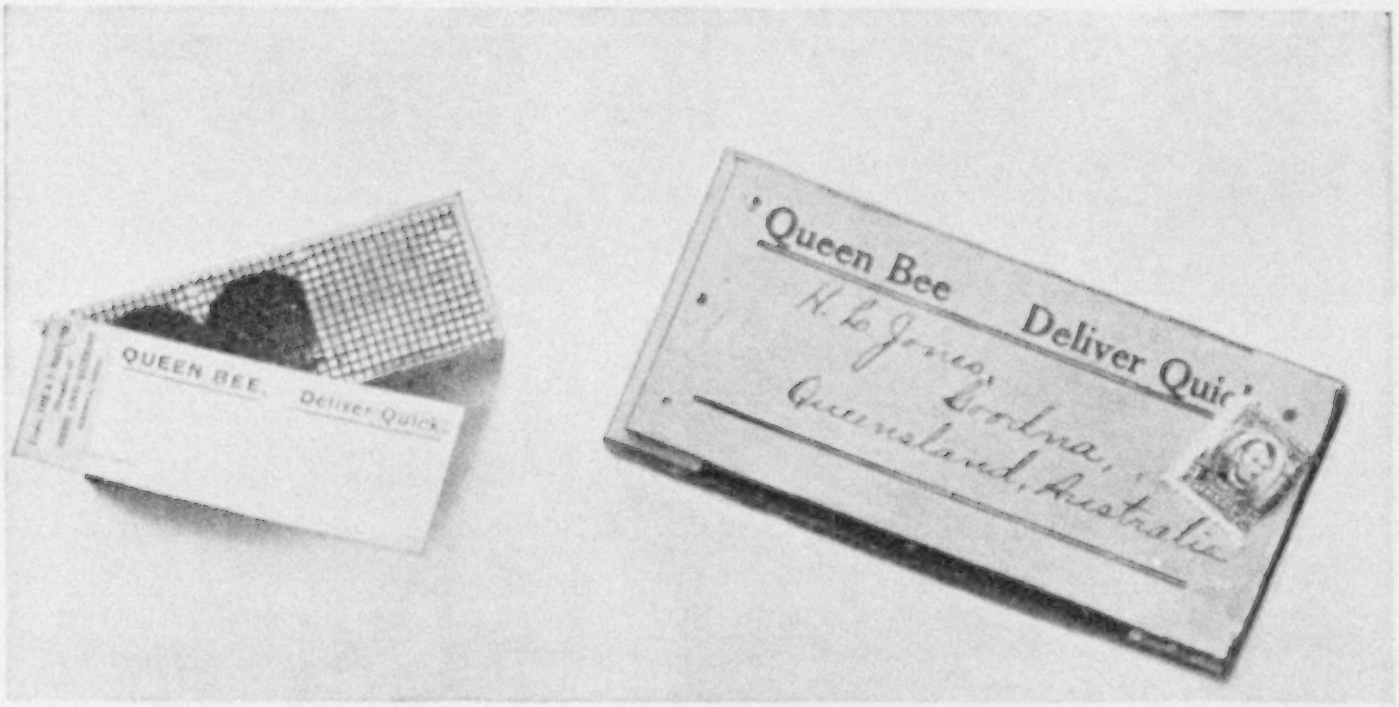
EDITOR OF "A B C AND X Y Z OF BEE CULTURE" HANDLING BEES: A COMFORTABLE POSITION FOR ALL-DAY WORK

Note that the left arm that supports the weight of the frames rests comfortably on the knee. Photo from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root

adventure. Swarms do sometimes start out without a queen accompanying them, but they usually go back to the hive, after a time, to try it again next day. If she does not go then, nor at the next attempt, they often wait until they can rear a new queen, and then go off with her. After we were pretty well satisfied that this is the correct idea of their plan, a little circumstance seemed to upset it all.

A neighbor, wanting to make an observatory hive, drummed perhaps a quart of bees from one of his old hives. As he had no queen, we gave him a black one, taken from a colony purchased several miles away. We mention this to show that the queen had never been out of the hive in the location which it then occupied.

After a day or two this neighbor informed us that we had played a fine trick on him, for our queen had gone home and taken his quart of bees with her. We told him it was impossible, for she had never been out of the hive, ex-



Photos from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root

HOW BEES AND QUEENS ARE PUT UP IN A MAILING CAGE: INSERTING THE CAPTIVE QUEEN IN HER CAGE

BENTON MAILING CAGE, IN WHICH A QUEEN BEE CAN SAFELY TRAVEL FROM THE UNITED STATES TO AUSTRALIA

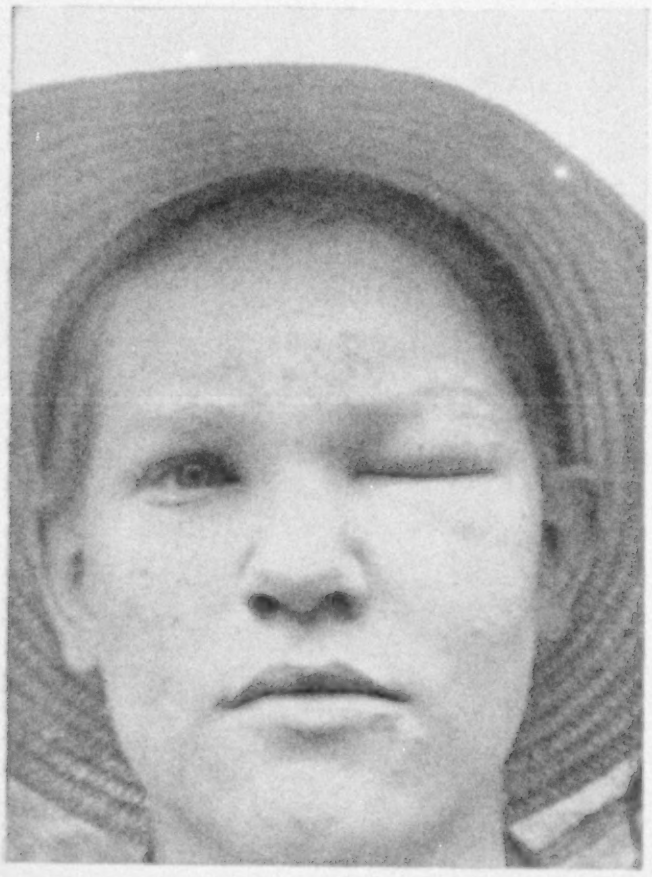


Photo from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root

EFFECT OF A STING NEAR THE EYE

cept when we carried her over in the cage.

We went and looked in the hive she came from, and there she was, true enough, with the bees she had brought with her stung to death in front and on the bottom-board. It is possible that the bees swarmed out first; but, even if they did, they certainly followed the queen in going back to her old home. We also know that bees sometimes follow a young queen when she goes out to take her wedding-flight.

It is our opinion that neither queen nor workers alone make the first start, but all hands join together and act in concert.

While it is true that a swarm will issue without any previous preparation when a swarming craze is on in the yard, the great majority of colonies preparing to swarm send out scouts, or prospectors. These bees hunt up cavities in hollow trees, or even seek out empty hives, and commence "cleaning house". The number of scouts having located a home will increase until there appears to be quite a little swarm, and sometimes one is led to believe there is a case of robbing going on, especially if the scouts have entered an empty hive containing combs. They will continue to make their visitations day by day, and in the meantime they busy themselves by cleaning house.

When the day comes for the swarm to issue, the scouts appear to make it their business to lead the flying bees to this new location. Just how they do this cannot be definitely shown; but that they do lead these swarms to particular abodes has been so clearly proven that there is no further question about it. This shows why a swarm will sometimes "light out" without even clustering. Following the lead of their scouts, they will go directly to their new home, which has been already prepared.

As a general rule a swarm clusters first. Whether this is for the purpose of getting the scouting party "organized" and into action no one knows. If the scouts have not already found a location, it is possible that the clustered swarm is sending out some scouts to prospect; and, having found a hollow tree, they will go back to the cluster, when all will "hike" for the new home.

While these may be fanciful suggestions, it may account for the reason why a swarm will sometimes hang on a tree for several days, the inference being that the scouts have failed to locate any suitable home.

BEES DO NOT INJURE SOUND FRUIT

Every now and then we hear complaints of how bees will attack and eat up fruit; and, to a casual observer, at least, they apparently do bite through the skin and extract the juices until the specimen is shriveled up to a mere semblance of its former shape and size. Careful investigation has shown repeatedly that bees never attack sound fruit, no matter how soft the skin nor how juicy and pulpy the contents within the skin.

The authors have had, during the past 30 years, between 300 and 400 colonies

BEES WITH MASSES OF POLLEN ON THEIR LEGS

Note the bee in the lower right-hand corner, with two masses of pollen almost as large as its body. The rear legs of each bee have a "pollen-basket," to which is transferred the pollen which it gathers by means of its tongue and the rough hairs and spines on its fore and middle legs. On entering the hive the bee crosses its pollen-laden legs and then kicks the loads off to the bottom of the cells. Nursing bees then take the pollen and mash it down into a hard cake for food for the brood (see page 679). Photo from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root.

Photo from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root

LIMB OF A TREE CUT OFF WITH THE SWARM READY TO HIVE

located in a vineyard at their home apiary. Notwithstanding hundreds and hundreds of pounds of grapes are raised every year, the bunches hanging within three or four feet of the entrance of the hives, the sound fruit is never attacked, but during a dearth of honey, a broken or otherwise bruised bunch of grapes will occasionally be visited by a few bees.

The writer of this article has attended various horticultural and pomological conventions, both State and national. Among the progressive fruit-growers and horticulturists there is a general acknowledgment that bees do not attack sound fruit; that the little damage they do to damaged fruit is compensated for a hundred times over by the indispensable service they perform in pollinating fruit-blossoms early in the season, when no other insects or means of mingling the pollen exists. Indeed, some of our best fruit-growers are now keeping a few hives of bees in each of their orchards. Often they invite bee-keepers to locate yards of bees either in the orchards or as near as it is practicable to put them.

But a casual observer might easily get the impression that bees not only suck damaged fruit dry, but actually puncture and eat up sound fruit. Some years ago a neighbor sent word to us that he would like to have us come up to his vineyard and he would give us undisputable proof that our bees were actually puncturing his grapes and sucking out the fruit.

We looked at the luscious bunches as they were hanging down, and, sure enough, there were small, needle-like holes in almost every berry that the bees were working on. It looked like a clear case of "caught-in-the-act" evidence against them. For the time being we were unable to offer a satisfactory explanation. We brought the matter to the attention of an old farmer who had been a bee-keeper for many years. Finally one morning he sent word to us that he had found the guilty culprit, and that if we would come down to his place *early* some morning he would point him out. This we did.

He showed us a little bird, quick of flight, and almost never to be seen around the vines when any human being

Photos from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root

A VIEW OF THE APIARY OF A. I. ROOT CO., SHOWING HIVES IN THE FOREGROUND, WITH A GRAPEVINE AT EACH HIVE (SEE PAGE 686)

A SWARM ENTERING A HIVE

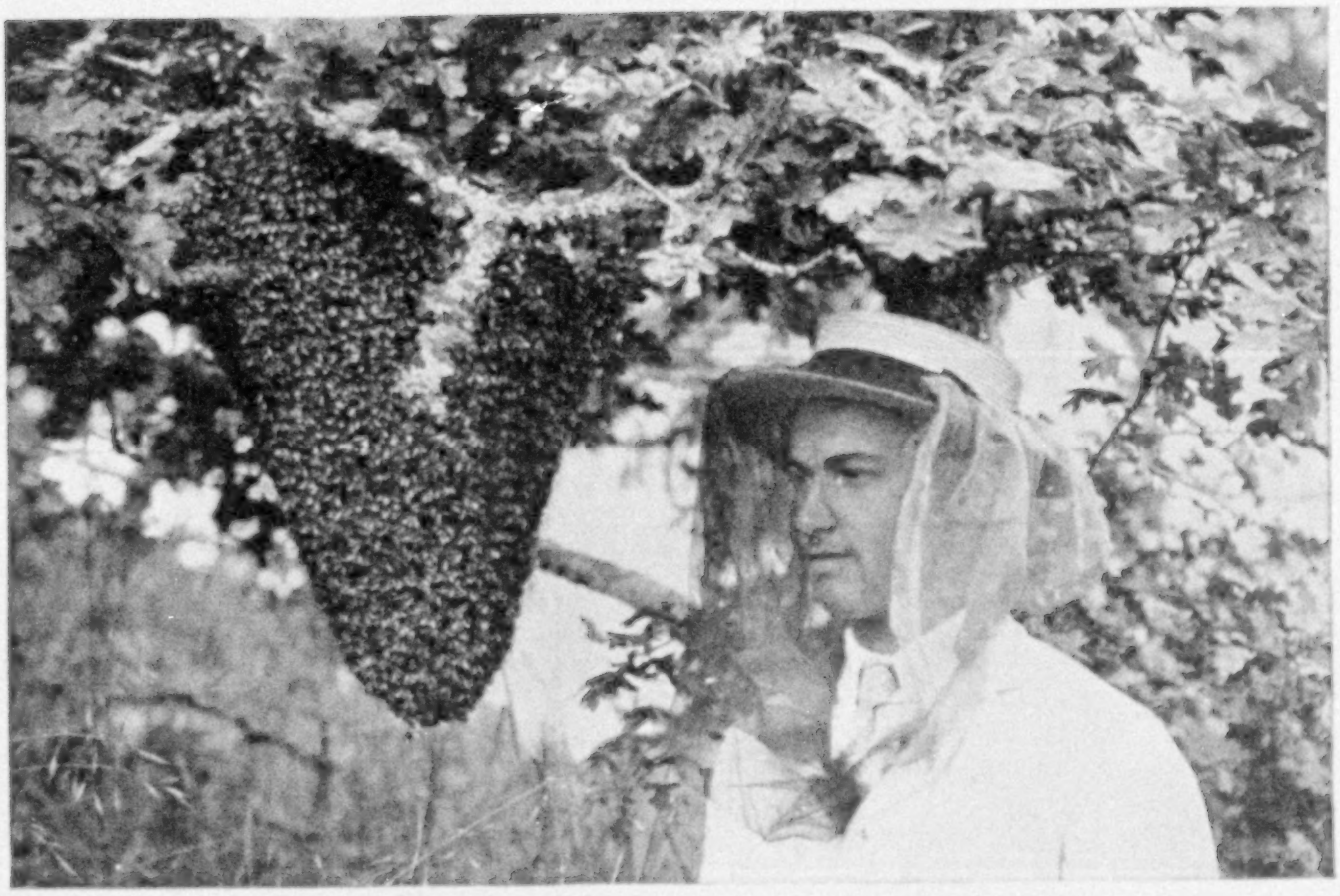


Photo from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root

A FINE, SYMMETRICAL SWARM WITHIN EASY REACH

was present. This bird, about the size of a sparrow, striped, and called the Cape May warbler (*Dendroica tigrina*), has a long, sharp, needle-like beak. It will alight on a bunch, and, about as fast as one can count the grapes, will puncture berry after berry.

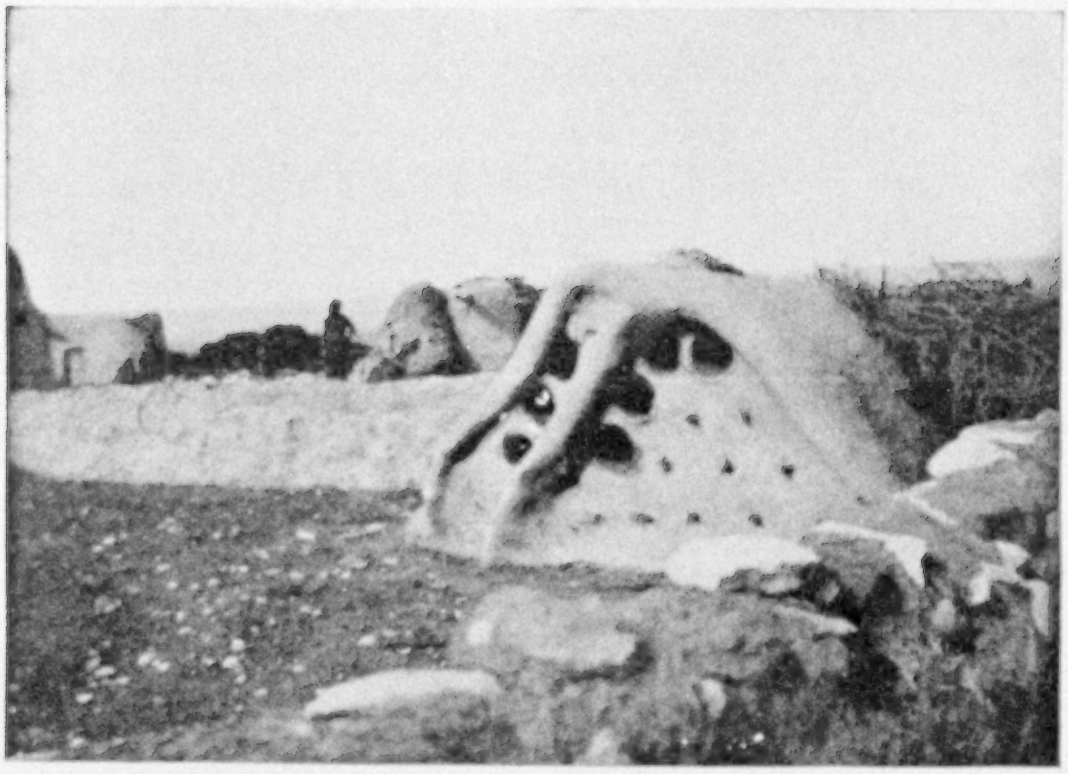
After his birdship has done his mischief he leaves, and then come the innocent bees, during the later hours of the day, and finish up the work of destruction by sucking the juices and the pulp of the berry until it becomes a withered skin over a few seeds. While the birds during the early hours of the day are never seen, the bees, coming on later, receive all the credit for the mischief.

The Cape May warbler is not the only bird guilty of puncturing grapes. There are many other species of small birds that learn this habit, and among them we may name the ever-present sparrow and the beautiful Baltimore oriole, the sweet singer that is sometimes called the swinging bird, from its habit of building its nest on some overhanging limb.

BEES AND ANTS

Although we have given the matter considerable attention, we cannot find that ants are guilty of anything that should warrant, here in the North, the apiarist in waging any great warfare against them. Some years ago a visitor frightened us by saying that the ants about our apiary would steal every drop of honey as fast as the bees could gather it. Accordingly we prepared ourselves with a tea-kettle of boiling water, and not only killed the ants, but some grapevines growing near.

Afterward there came a spring when the bees, all but about 11 colonies, dwindled away and died, and the hives filled with honey, scattered about the apiary unprotected, seemed to be as fair a chance for the ants—that had not "dwindled" a particle—as they could well ask for. We watched to see how fast they would carry away the honey; but, to our astonishment, they seemed to care more for the hives that contained bees than



MUD BEEHIVES IN JEZREEL, PALESTINE
Photo by I. W. Metcalf, Oberlin, Ohio; from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root

DUTCH SWARM SPECIALISTS INSPECTING BARGAINS AT THE BEE-MARKET IN HOLLAND
Contrast with the simplicity of the American hive. Photo from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root

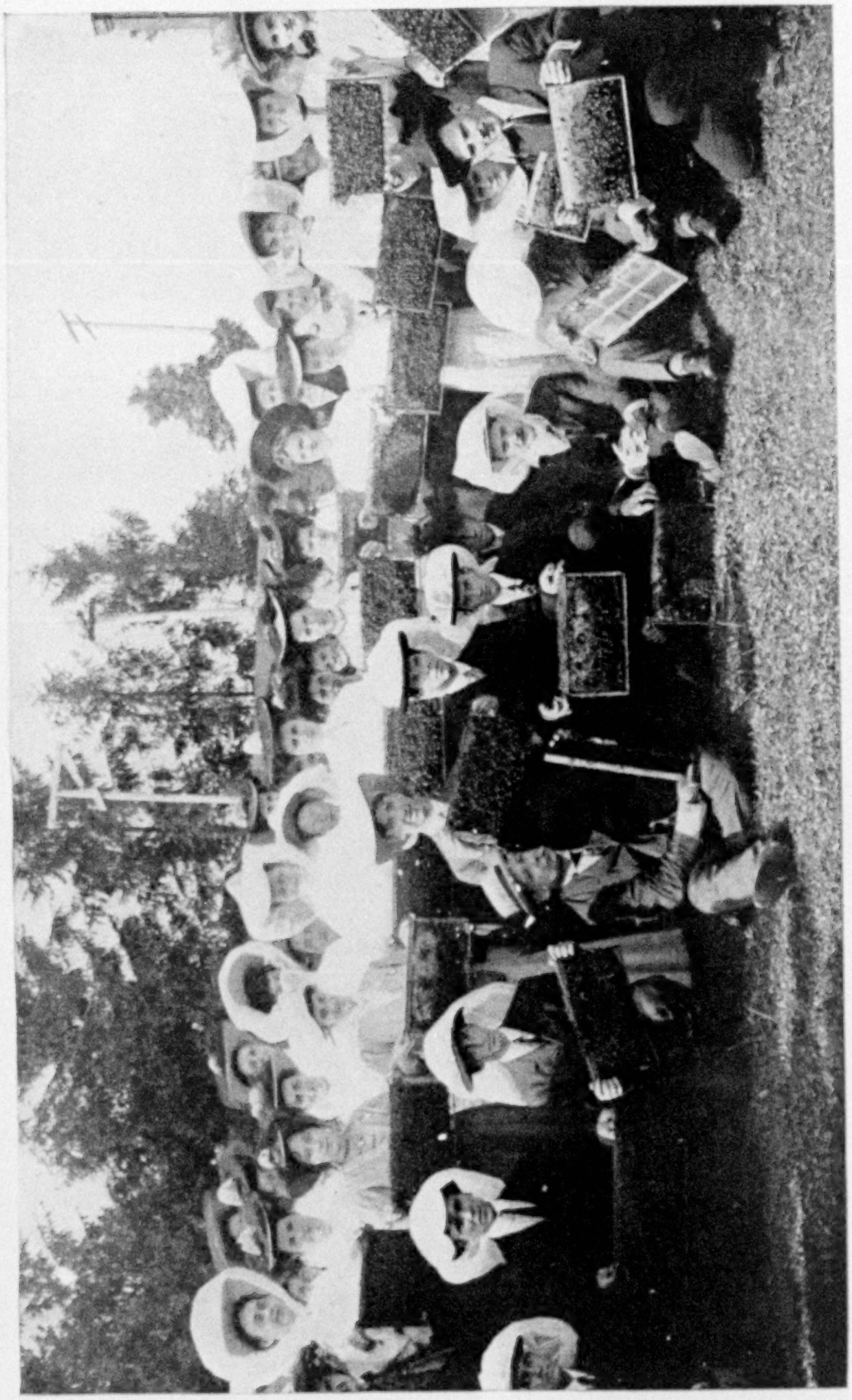


Photo from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root

SCHOOLMA'AMS AND SCHOOLMASTERS, AFTER TAKING THEIR FIRST LESSON IN BEE-KEEPING AT THE A. I. ROOT COMPANY'S HOME APIARY, MEDINA, OHIO

for those containing only honey. We soon determined that it was the warmth from the cluster that especially attracted them; and, as the hives were directly on the ground, the ants soon moved into several that contained only a small cluster and for a while both used one common entrance.

As the bees increased they began to show a decided aversion to having two families in the same house, although the ants were evidently inclined to be peaceable enough until the bees tried to "push" matters, when they turned about and showed themselves fully able to hold possession.

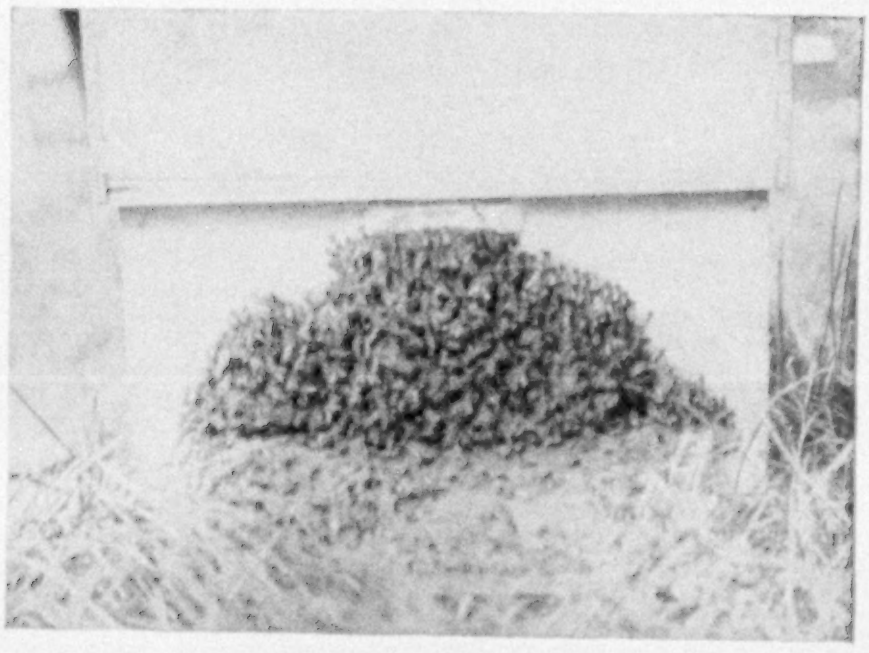


Photo from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root

A COLONY WITH AN ENTRANCE TOO SMALL, WHERE THE BEES HAVE FORMED THE LOAFING HABIT

The bees seemed to be studying over the matter for a while, and finally we found them one day taking the ants, one by one, and carrying them high up in the air and letting them drop at such a distance from their home that they would surely never be able to walk back again. The bees, as fast as they became strong colonies, drove the ants out; and our experience ever since has been that a *good* colony of bees is never in any danger of being troubled in the least by ants. One weak colony, after battling awhile with a strong nest of the ants, swarmed out; but they might have done this anyway, so we do not lay much blame to the ants.

But ants do prove to be very annoying in those apiaries where there is any attempt to keep the grass down with a lawn-mower. The little hillocks that they make all over the yard disfigure it to some extent, as well as forming more or less obstruction to the scythe and lawn-mower.

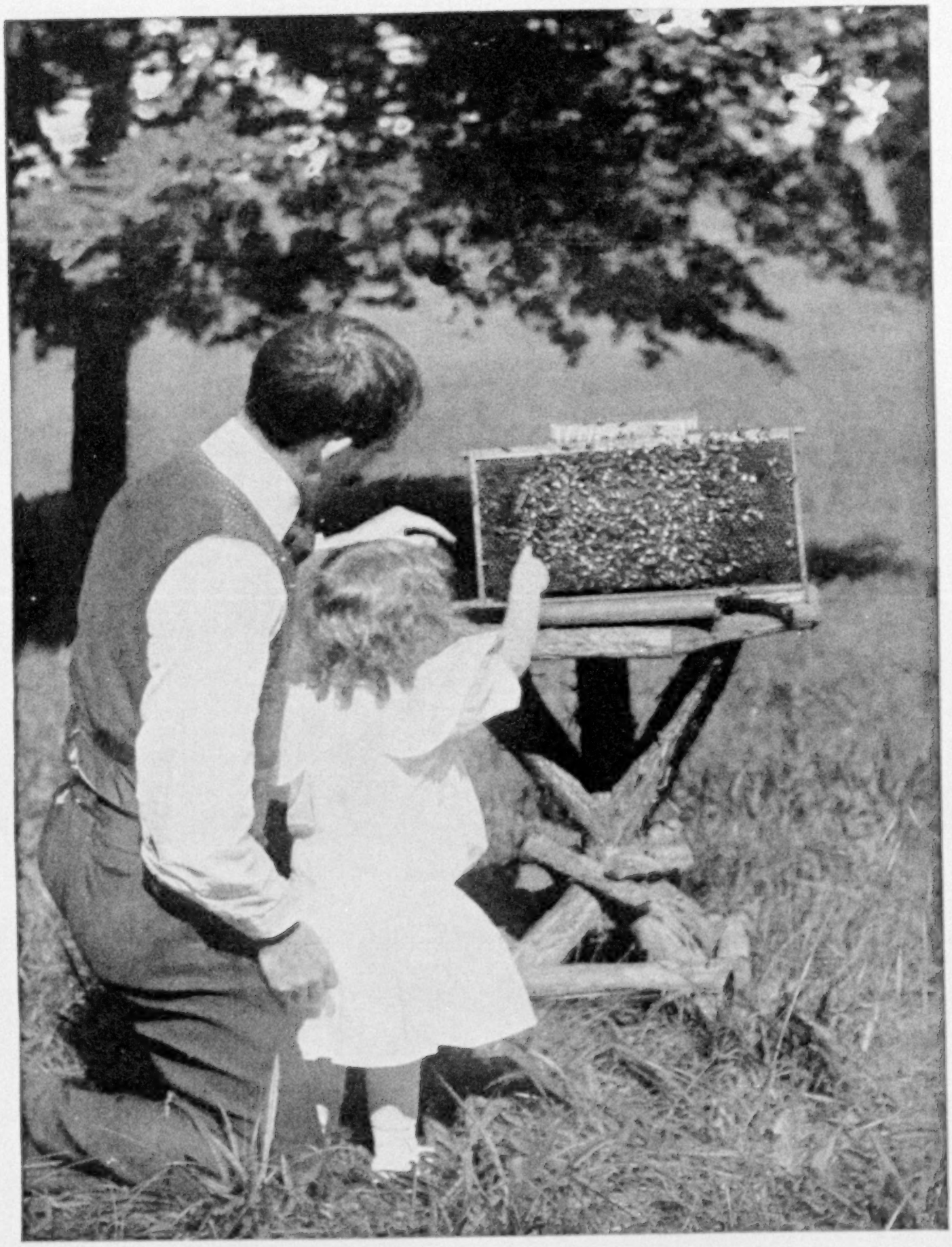
BREEDING BEES FOR IMPROVED VARIETIES

In the breeding of domestic animals it is possible to mate together a choice male and a choice female. Much could be accomplished in the way of improved stock if we could also control the male parentage of bees, and we do not know but that in-breeding, according to modern methods now known in stock-raising, might secure for us a race of bees greatly superior to anything we now know.

Just at present it seems very desirable that bees with longer tongues be bred, so that the nectar in the deep corolla-tubes of red clover, in the horsemint of Texas, and the mountain sages of California, as well as hundreds of other flowers, could be reached. Tons and tons of honey might thus be secured that otherwise goes to waste.

*Bee-keeping is one of the best of the life-saving, nerve-healing avocations. It takes the mind from household cares as completely as would a trip to Europe, for one cannot work with bees and think of anything else. Some of the attributes which make bee-keeping an interesting avocation I will mention. First of all, bees are such wonderful creatures and so far beyond our comprehension that they have for us always the fascination of an unsolved problem. I never pass our hive without mentally asking, "Well, you dear little rascals, what will you do next?"

*This and following paragraphs were written by Mrs. Anna B. Comstock.



KINDERGARTEN METHODS IN BEE-KEEPING

Looking for the queen. "There she is, daddy." Photo from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root

Photo from "A B C and X Y Z of Bee Culture," by A. I. and E. R. Root

HIVES OF BEES PACKED FOR EXPORT TO ARGENTINA

Bees are of particular interest to woman for several reasons: if she likes good housekeeping, then the bee is a model; if she likes a woman of business, again is the bee a shining light; if she is interested in the care of the young, then is the bee-nurse an example of perfection; if she believes in the political rights of woman, she will find the highest feminine political wisdom in the constitution of the bee commune. In fact, it is only as a wife that the bee is a little too casual to pose as ideal, although as a widow she is certainly remarkable and perhaps even notorious.

As a means of cultivating calmness, patience, and self-control, the bee is a well-recognized factor. Bees can be, and often are, profoundly exasperating; and yet how worse than futile it is to evince that exasperation by word or movement! No creature reacts more quickly against irritation than the bee. She cannot be kicked nor spanked; and if we smoke her too much we ourselves are the losers. There is only one way to manage exasperation with bees—that is, to control it—and this makes the apiary a means of grace.

The money-making side of bee-keeping is a very important phase in arousing and continuing the woman's interest in her work. I think woman is by birth and training a natural gambler, and the uncertainties of the nectar supply and of the honey market add to rather than de-

tract from her interest in her apiary. I know of several women who have made comfortable incomes and supported their families by bee-keeping; but, as yet, I think such instances are few. However, I believe there are a large number of women who have added a goodly sum yearly to their amount of spending money, and have found the work a joy instead of a drudgery.

Personally I have had very little experience with the commercial side of bee-keeping. Once, when our maddeningly successful apiary grew to 40 hives when we did not want more than a dozen at most, and the neighborhood was surfeited with our bounty, we were "just naturally" obliged to sell honey. We enjoyed greatly getting the product ready for market, and were somehow surprised that so much fun could be turned into ready cash.

As a matter of fact, both my husband and myself have absorbing vocations and avocations in plenty, so that our sole reason for keeping bees is because we love the little creatures, and find them so interesting that we would not feel that home was really home without them. The sight of our busy little co-workers adds daily to our psychic income.

We are so very busy that we have very little time to spend with them, and have finally formulated our ideal for our own bee-keeping, and that is to keep bees for honey and for "fun". We shall have plenty of honey for our own table, and just enough to bestow on the neighbors so they will not get tired of it; and fun enough to season life with an out-of-door interest and the feeling that no summer day is likely to pass without a surprise.

REVIEW OF GOOD BOOKS

"Roman Cities in Italy and Dalmatia." By A. L. Frothingham, Ph. D. Pp. 343; 8½ x 6 inches. 100 illustrations and map. New York: Sturgis & Walton.

Professor Frothingham, who holds the chair of Ancient History and Archæology at Princeton University, has produced in this a most valuable work. The picture of Ancient Italy and pre-Augustan Rome, drawn from her rivals, is of absorbing interest, and the author presents his observations in what might be termed popular form.

After a trip through Italy and Dalmatia, where the evolution of these centuries can be studied without foreign admixture, this book brings us back to Rome with a far more complete idea of its ancient art and culture.

"Lassoing Wild Animals in Africa." By Guy H. Scull. Pp. 135; 5½ x 8 inches. 32 photographic illustrations. New York: The Frederick A. Stokes Co. Price, $1.25 net.

We have had a number of valuable books on big game hunting in Africa with guns, but the account of this expedition into the heart of the big game country to lasso the lion, rhinoceros, cheetah, giraffe, hartebeest, etc., and making photographs of the operation is truly remarkable and of absorbing interest. Colonel Roosevelt has written an introduction, in which he says in part: "No hunting trip which took place in Africa was more worthy of commemoration, and the feats of roping these animals showed a cool gallantry and prowess which would rejoice the hearts of all men." The photographs of the actual operation, taken by the well-known English bird photographer, Kearton, are splendid.

"A Guide to Great Cities—Western Europe." By Esther Singleton. Pp. 350. 12 illustrations. New York: The Baker & Taylor Company. Price, $3.00 net.

This book, for the younger generation of travelers and readers, describes the great cities of France and Spain and Portugal. The value of holding the interest of youth has been well considered, and the volume will most certainly stimulate a geographical interest in the youthful breast.

"The Toll of the Arctic Seas." By Deltus M. Edwards. Pp. 440. 6¼ x 8½ inches. Illustrations with half-tones and 4 maps, including a map of the Arctic regions by Gilbert H. Grosvenor. New York: Henry Holt & Co. Price, $2.50 net.

This is an account of the principal exploring expeditions to the far north, commencing with Barents in 1594, and ending with Peary's conquest of the North Pole in 1909. The work of seventeen explorers is thus summarized.

It is a most useful book, for between its covers are told the main features of the exploration of the north and the search for the Pole. It is rather surprising to find such a work, which, of course, can hit only the high places—a series of very readable stories.

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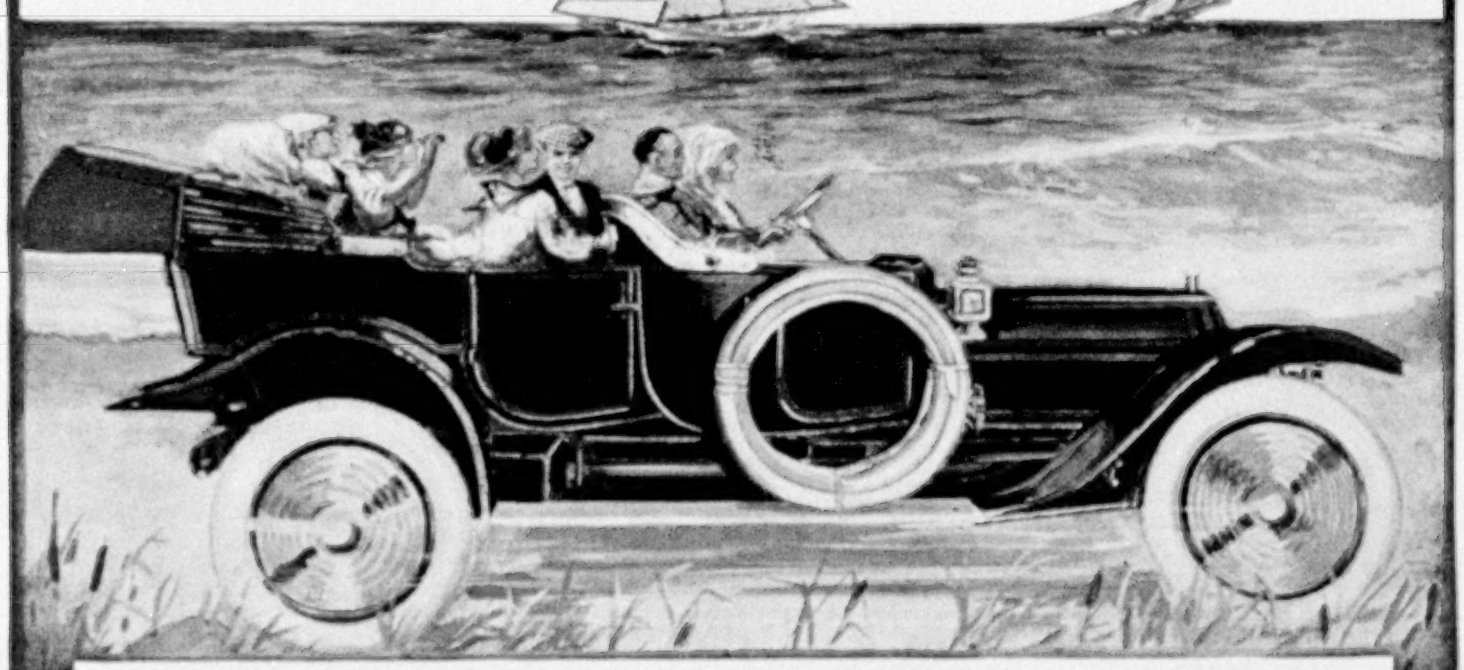

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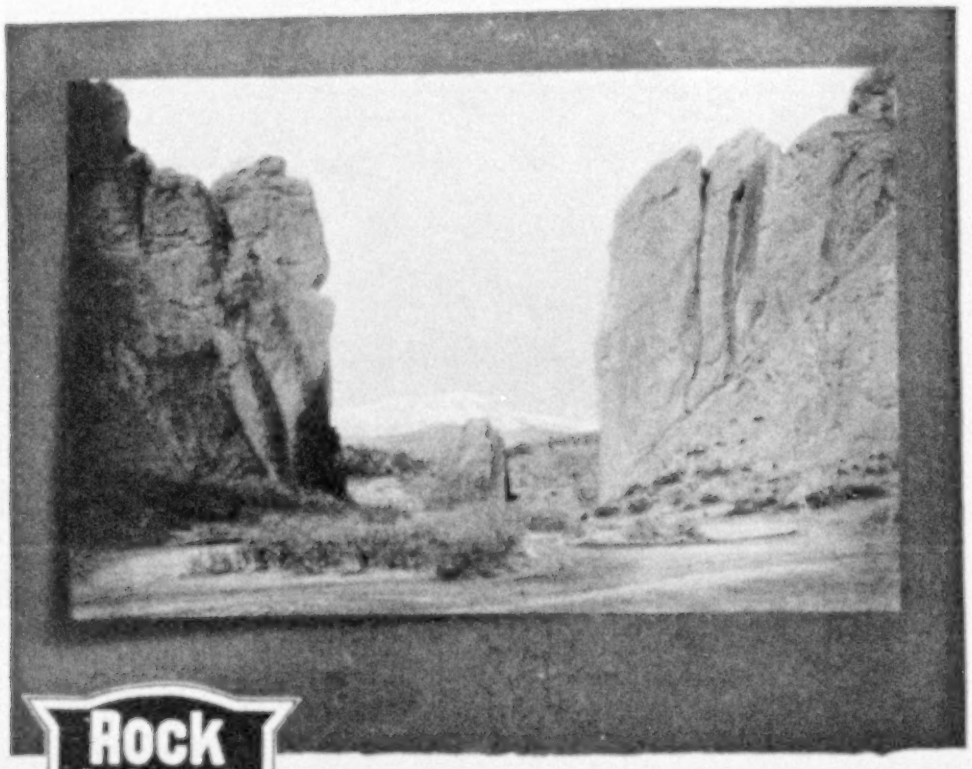

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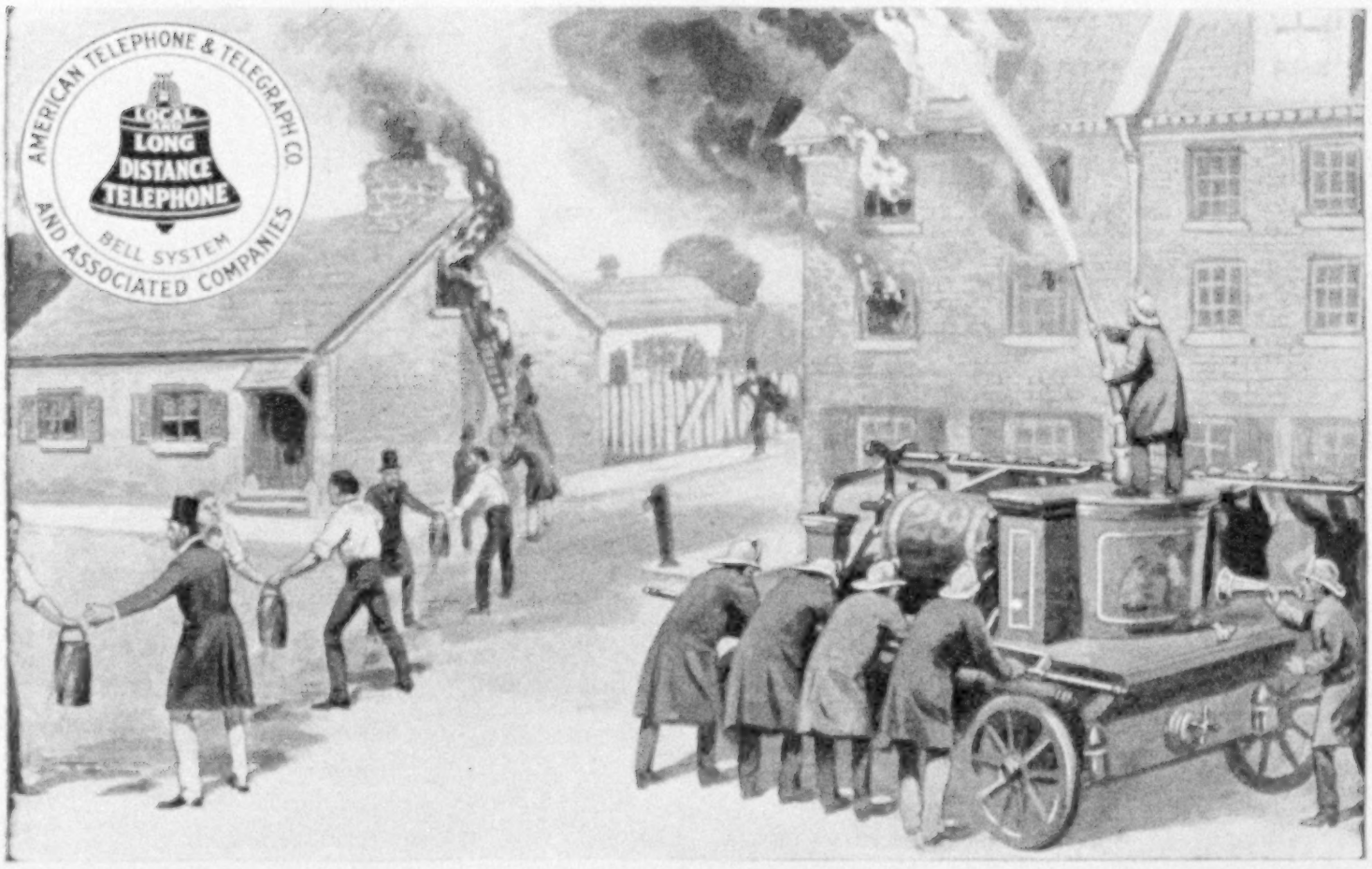

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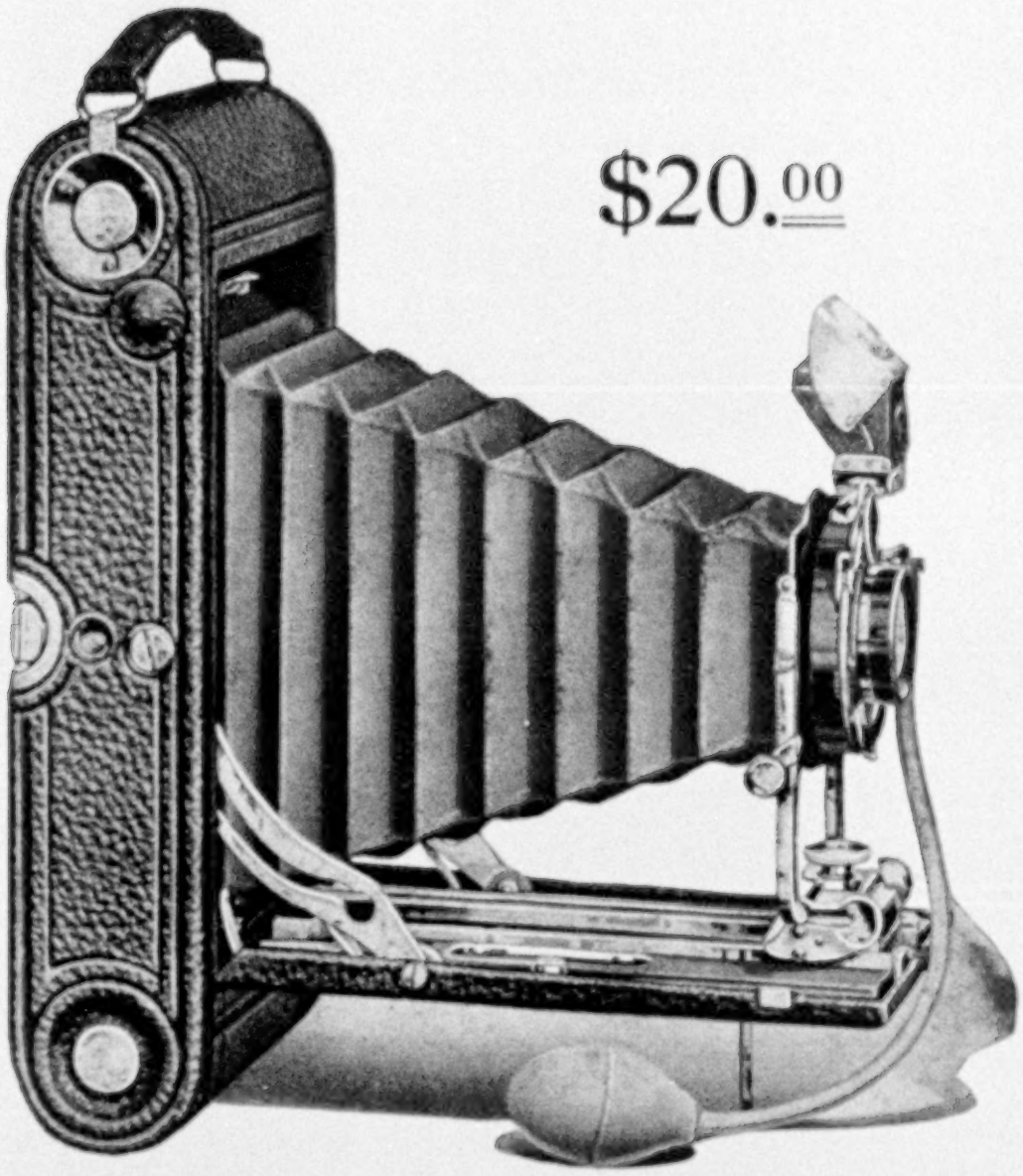

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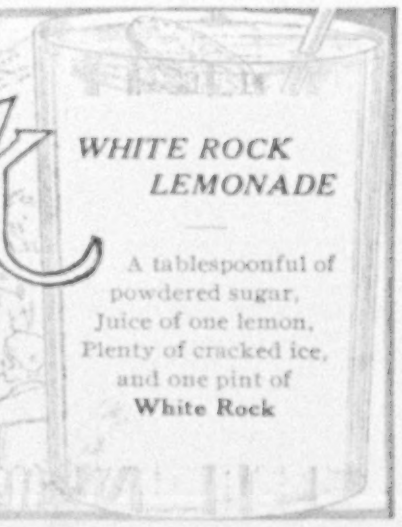

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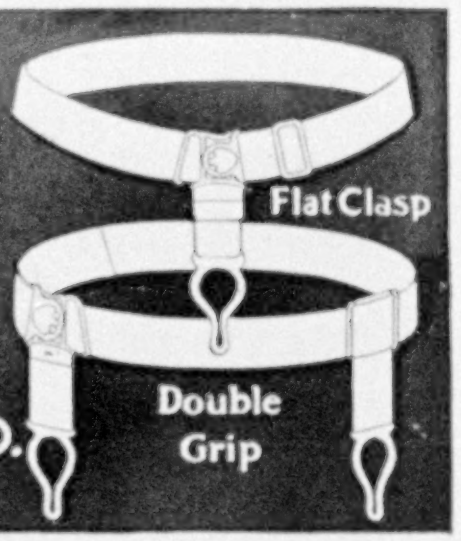

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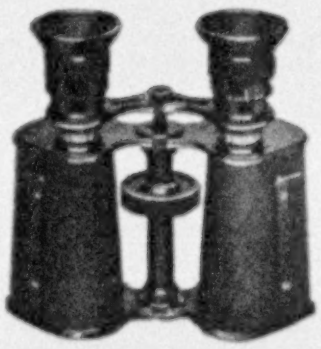

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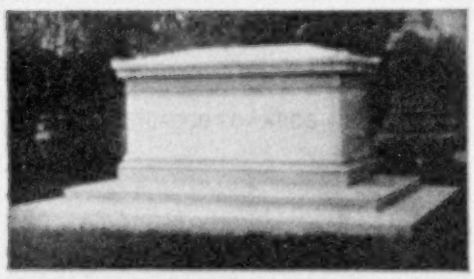

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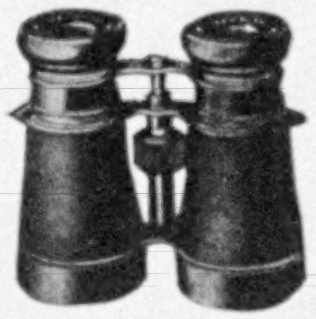

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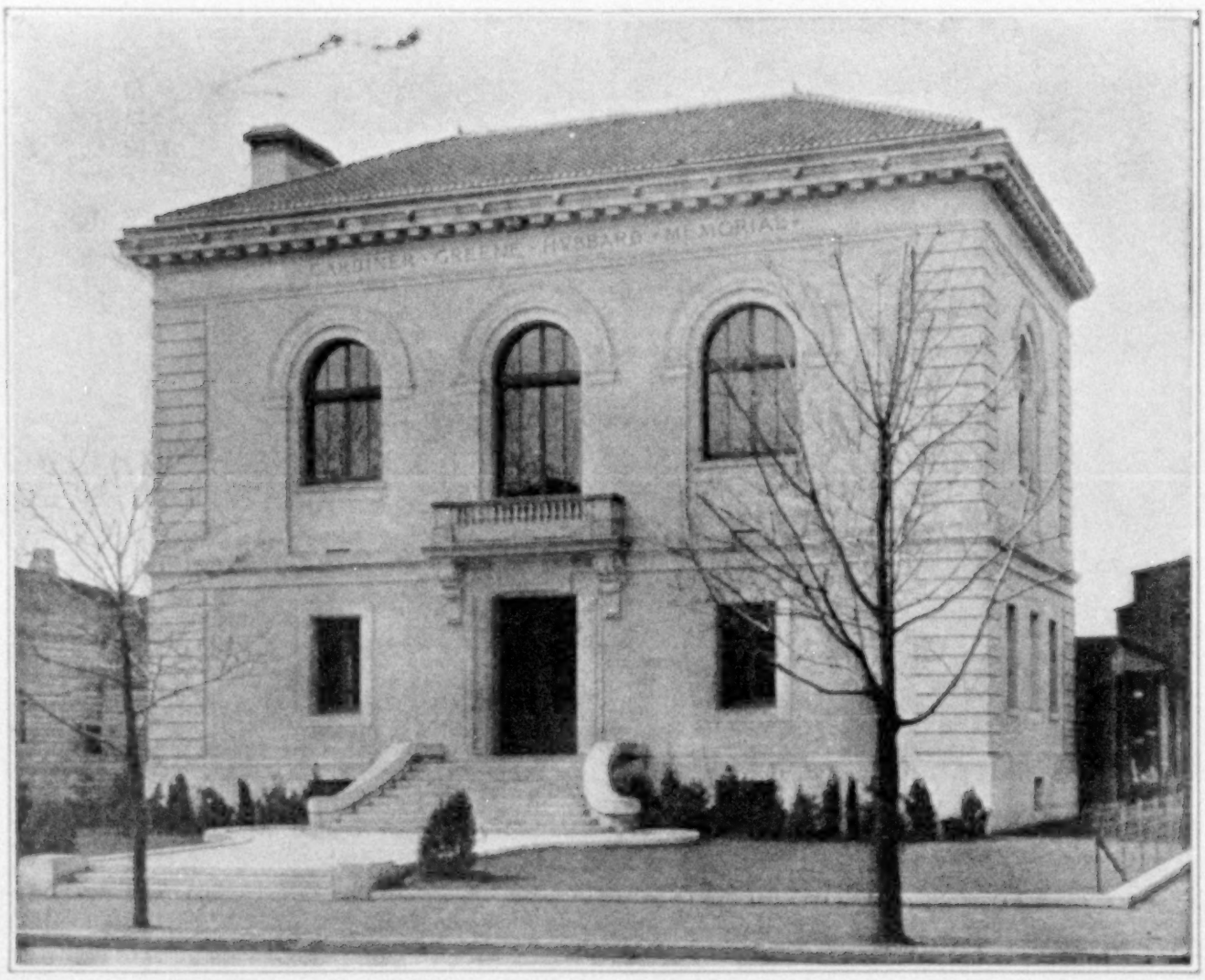

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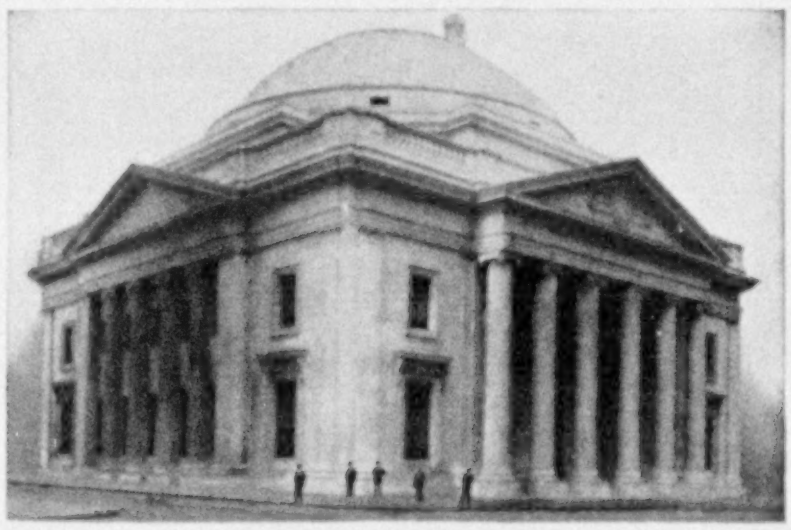

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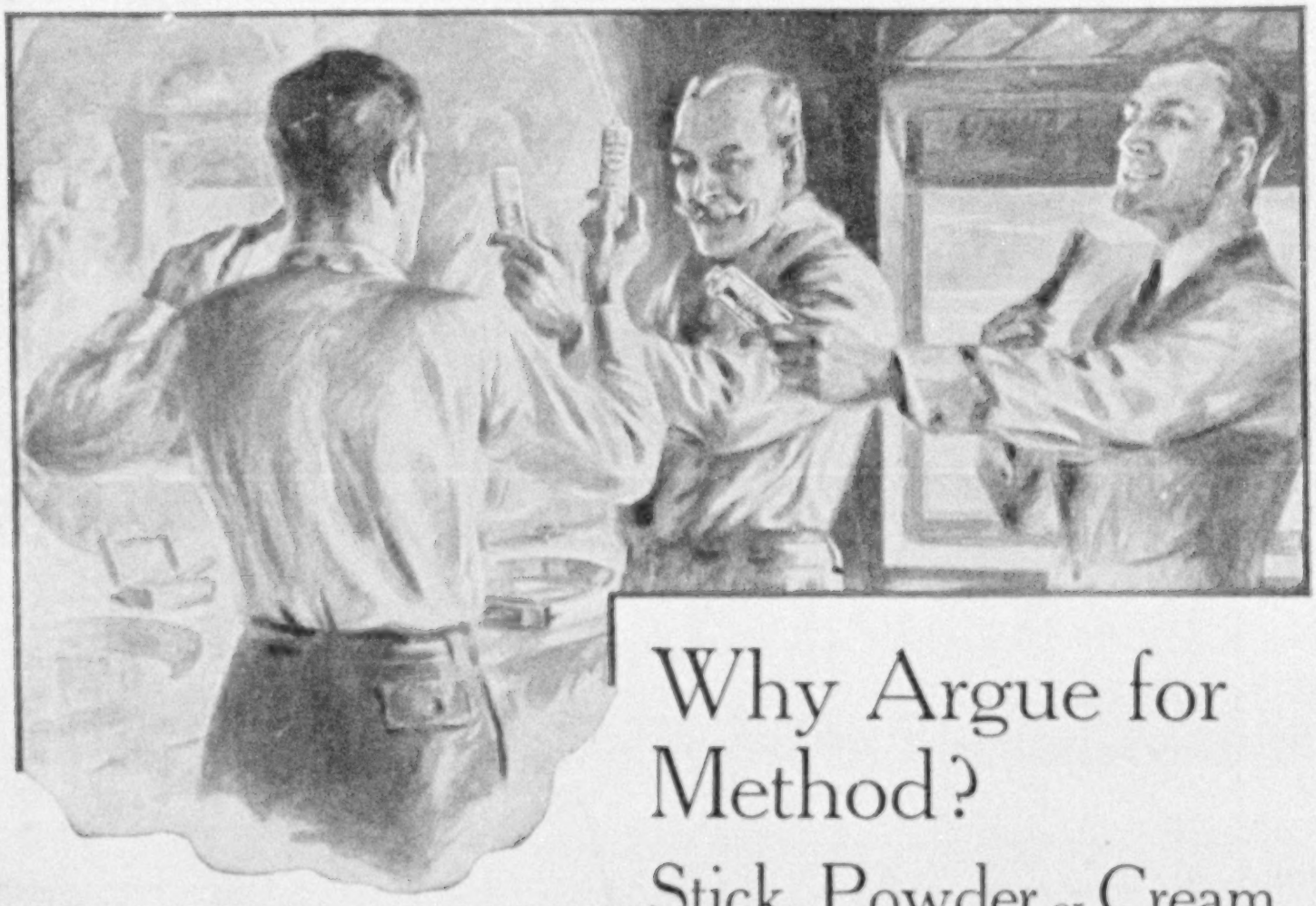

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